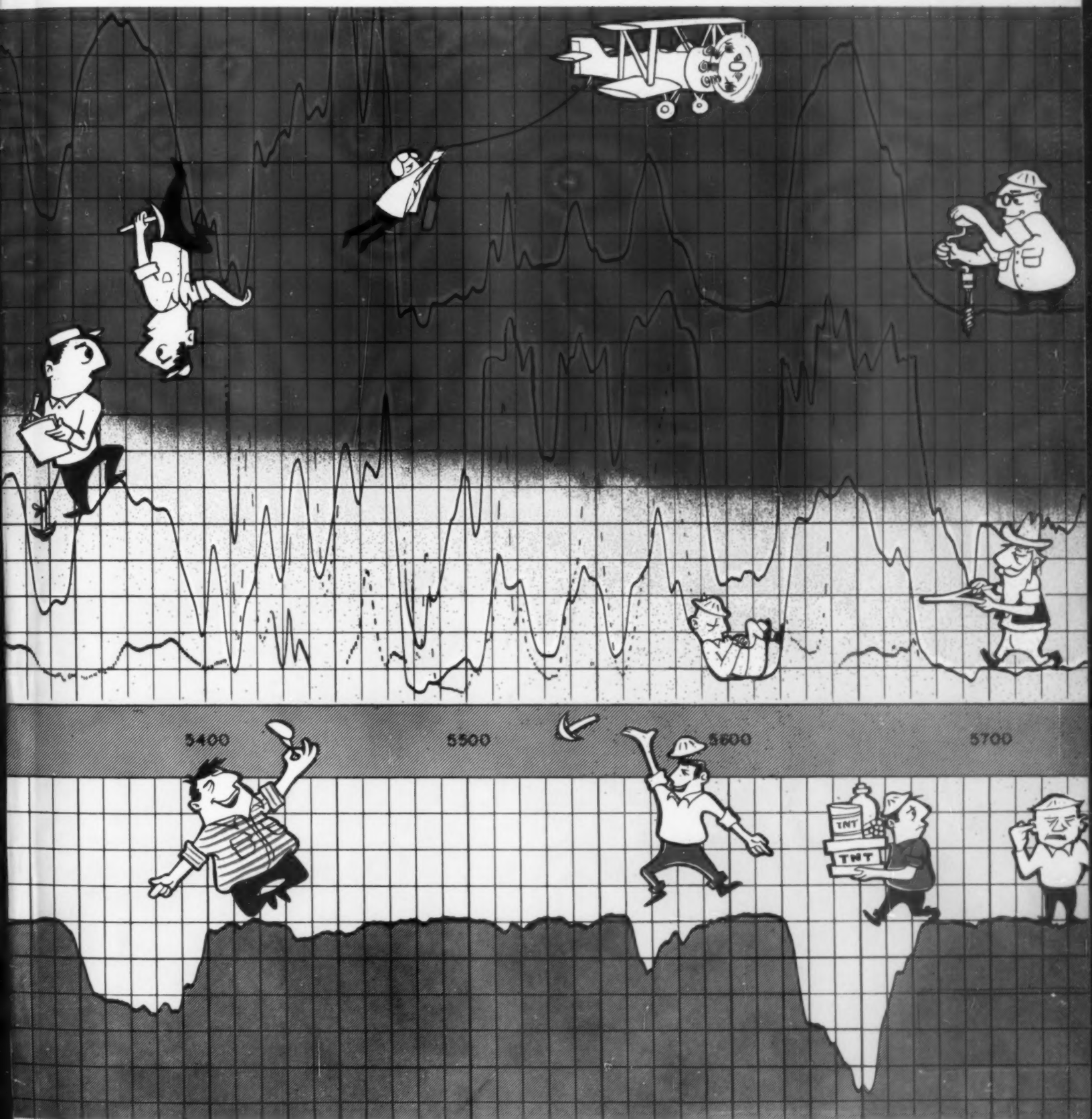
WORLD PETROLEUM

MARCH 1960



one dollar per copy

ten dollars per year

table of contents page 3

WARREN'S
resources of production,
transportation and storage,
plus . . .

WARREN'S
experience as a specialist
in its field
assures you of

DEPENDABLE *deliveries*

of **NATURAL GASOLINE**

Whatever the Grade, Whatever the Volume
When, Where and the Way *you* want it!

WARREN
PETROLEUM CORPORATION

TULSA, OKLAHOMA

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.

Laying-in is fast and easy with International Superior Sideboom on an International crawler. Your choice of hydraulic- or static-counterweighted sideblooms.

NO PIPELINE PROBLEMS

with International Power for Every Purpose

From clearing to clean-up, International pipeline equipment gives you speed, precision and economy. Only IH offers such a wide choice of crawlers, power units and crawler-mounted sidebooms, welders, blades and buckets to solve every problem.

Bonus-powered International Superior crawler sidebooms are unmatched for work capacity. For big jobs, choose the 230-hp TD-25 with 130,000 lbs. of sideboom lift. For smaller jobs, it's the TD-20 (72,500 lbs. lift), TD-15 (46,500 lbs.), TD-9 (18,000 lbs.). With backfill blade, lifting capacities are even greater.

Your International Construction Equipment Distributor has full information on all IH pipeline equipment.

Compact, high-output International TD-15 crawler-welder is the only factory-mounted unit available to pipeliners. Four leads . . . 325 amps . . . front pto driven . . . maximum flotation on any terrain . . . designed for reliability and long life on cross-country welding jobs.

Versatile International Drott 4-in-1 Skid-Shovel gives high-speed performance on back-filling and clean-up. Models for TD-9, TD-15 and TD-20 crawlers.

International TD-15 crawler with Model 150-W welder is faster and requires less manpower than any truck or skid-mounted welding equipment.

INTERNATIONAL HARVESTER

INTERNATIONAL CONSTRUCTION EQUIPMENT

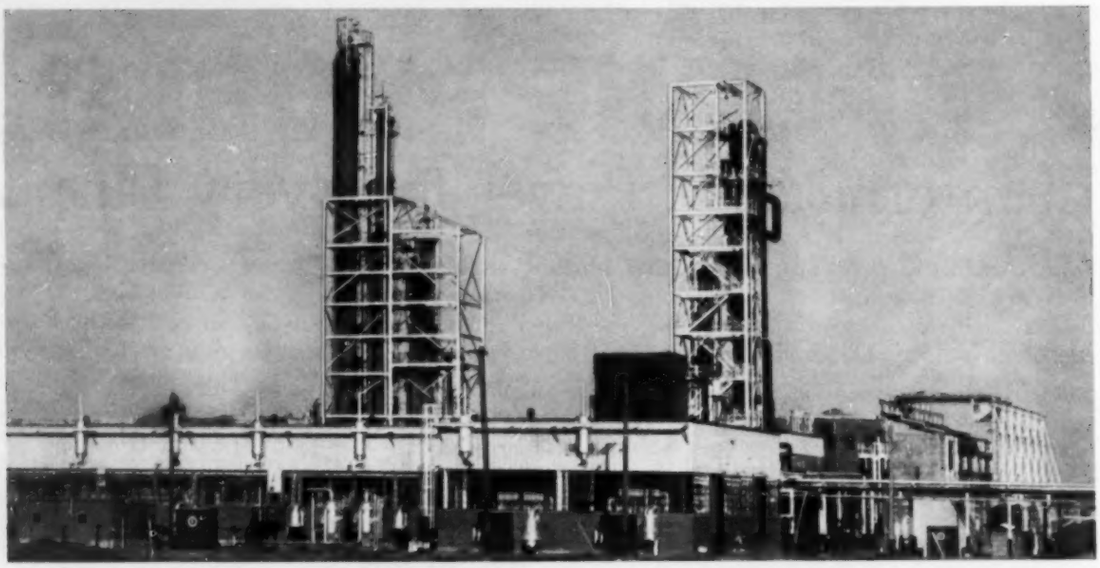
International Harvester Export Company, 180 N. Michigan Ave., Chicago 1, Illinois, U. S. A.

LUMMUS

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

ETHYLENE PLANT EXPANSION ON STREAM FOR CANADIAN INDUSTRIES LIMITED

Lummus Designs and Engineers 85% Expansion of Ethylene Plant at Edmonton, Alberta, Canada



Expansion of C-I-L's ethylene facilities at Edmonton, Alberta, Canada, is completed and the plant now has a capacity of 46 million lbs. per year of high purity ethylene. The entire output of this unit is used by C-I-L to manufacture polyethylene.

Lummus designed and engineered the expansion of the existing cracking facilities, built in 1953, for the increased production of ethylene, and the ethane recovery unit for extracting ethane from natural gas.

As originally designed, the plant recovered ethylene from the cracking heater effluent and ethane from natural gas by oil absorption. In the expanded plant additional capacity is obtained by withdrawing the natural gas portion and increasing the heater effluent.

The new low temperature ethane recovery plant has a demethanization unit which utilizes ethylene refrigeration to temperatures as low as −145°F. At C-I-L's request sufficient capacity has been designed into this unit to permit another expansion step in the future.

Up-to-date equipment was employed to ensure economical and efficient operation. Special efforts were made, wherever possible, to incorporate existing equipment into the expanded plant.

In addition to the C-I-L expansion project, Lummus has designed 13 complete ethylene plants, with a combined total capacity of over one billion pounds per year.

Over 800 plants have been designed, engineered and constructed by Lummus for the process industry throughout the world in the last fifty years. Why not discuss your next project with a Lummus representative?

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, New York, Houston, Washington, D. C., Montreal, London, Paris, The Hague, Madrid; Engineering Development Center: Newark, N. J.

WORLD PETROLEUM FOR MARCH, 1960. Vol. 31, No. 3, March, 1960. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, 109 Market Pl., Baltimore, Md. Editorial and Executive offices, 604 Fifth Avenue, New York 20, N. Y. Accepted as a controlled circulation publication at Baltimore, Md. Subscription rate: $10.00 per year. Single copies $1.00.

FOUNDED BY RUSSELL PALMER

Publisher MONA PALMER
Editor J. C. CHATFIELD
Managing Editor G. H. BARROWS
Processing Editor WILLIAM C. UHL
European Editor CECIL W. WOOD
Production Manager DORIS N. O'HARA
Art Director CHARLOTTE BLASS

Member of National Business Publications, Inc., and Business Publications Audit of Circulation, Inc.

SUBSCRIPTIONS

1 year , $10.00 2 years, $18.00
3 years, $25.00 Single copies $1.00

GENERAL OFFICES

604 Fifth Avenue, New York 20
(Tel. JUdson 6-4820)

BRANCH OFFICES

EUROPEAN OFFICE LONDON, ENGLAND

G. L. Fetherstonhaugh, St. Paul's Corner, Ludgate Hill, London, E.C.4.
(Tel. CITY 5318)

TORONTO 1, ONT., CANADA

Allis Associates 12 Richmond St. East
(Tel. EMpire 4-2001)

MONTREAL P.Q., CANADA

Allis Associates 2055 Mountain St.
(Tel. Victor 5-6898)

WASHINGTON, D. C.

J. B. Huttlinger National Press Building
14th and F Streets (Tel. EX. 3-3733)

LOS ANGELES 14

T. T. Drake 412 West Sixth St.
(Tel. MAdison 8-1391)

NEW YORK 20

Sales Representative
E. L. Townsend
604 Fifth Avenue (Tel. JUdson 6-4820)

TULSA 3

O. F. Cozier and Jack F. Cozier
695 Mayo Bldg. (Tel. Diamond 3-1335)

CLEVELAND 7

Richard E. Cleary, 15515 Detroit Ave.
(Tel. LAkewood 1-7125)

World Petroleum is published by
Mona Palmer, Trustee
under the will of Russell Palmer
© Mona Palmer Trustee, 1960

VOL. 31, NO. 3, MARCH, 1960

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

CONTENTS

4 Washington Pipeline, *by Joseph B. Huttlinger*

6 London Letter, *by Cecil W. Wood*

12 International News and Notes

16 Latin American Oil News

39 Editorial—Prepared to Meet the Challenge, *by T. O. Hall*

40 Wildcatting is World Wide

44 Killing Three Birds with one Stone, *by Robert J. Riggs, Jr.*

46 The Human Side of Geophysics, *by Lloyd Paitson*

48-70 News Tools for the Geophysicist

50 The Stratigraph—a new Research Device, *by Edoardo Merlini*

51 USA and Canada Stratigraph Studies

52 New System Cuts Marine Seismic Costs 80% to 90%

53 Airborne Gravity Meter Tested

60 The "Decatrack," *by J. M. Cunningham and R. E. Norris*

60 Nuclear Magnetism Logging

72 Review of recent USA Patents on Catalysts, *by Heinz Heinemann and P. A. Lefrancois*

76 World Processing Review, *by Wm. C. Uhl*

84 Oil Company Staff Changes

90 Canadian Notes

104 Advertisers' Index

THIS MONTH'S COVER

This amusing cartoon was originally published as a cover for *Newsvent*, house magazine of The British American Oil Producing Co. and the Toronto Pipe Line Co. Drawing is by *Newsvent*'s staff artist Albert P. Cinque of Wheeling, W. Va. It is reproduced here through the courtesy of Andy Tarvin, editor of *Newsvent*.

ANNUAL INDEX AVAILABLE

Editorial indexes for all 1959 issues of WORLD PETROLEUM are available without cost on request to the editor. Microfilm copies of all issues are available from University Microfilms, Ann Arbor, Michigan.

Washington PIPE LINE

by Joseph B. Huttlinger

There's an important issue at stake in the President's request to Congress to raise the gasoline tax from four cents a gallon to 4.5 cents. It is whether the gasoline tax shall be virtually the only source of revenue for federal road building or whether it shall have help from taxes on new cars, auto parts and accessories.

President Eisenhower is leaning to the gasoline tax alone. He asked a higher gasoline tax, and suggested that Congress take away from the highway fund certain revenues now going into it. These include about $17 million a year in taxes on aviation gasoline and a larger new car and auto parts taxes scheduled for 1961. Finally, the President asked that the trust fund take over the job of paying for forest and public land highways now paid for by the general revenues.

The President explained that road building has "been slowed below a desirable rate of progress" because Congress raised the gasoline tax only a penny last year. At the U. S. Capitol, the President's request met a chilly reception. The outcome is likely to remain in doubt until the end of the present session of Congress next summer.

Broad Depletion Study

Secretary of the Treasury Robert B. Anderson said any study of the income tax depletion allowance for oil and gas should embrace depletion for all other minerals. He told a press conference that the depletion provision has become part of "the fabric" of the tax structure and now applies to all minerals. "If a study is made, it should be examined as a collective item," rather than on just one or two minerals, he explained.

Asks Billion Tax Rise

The budget message doesn't emphasize it, but President Eisenhower is asking tax increases totaling about one billion a year. The new revenue would come from higher postal rates, gasoline taxes and levies on cooperatives and in changed depreciation treatment for business.

A press conference turned up laughter as a reporter asked Budget Director Maurice Stans why he called these "revenue adjustments" instead of tax increases. Stans replied these are taxes on "special users" who should pay for the services they are getting.

The reporter asked. "Have you any estimate of how many persons don't ever use the highways or write letters?"

After the laughter died down, Stans explained that some persons use the mail more than others, for they write or receive more letters.

"If you sprinkle your lawn every day and your neighbor sprinkles his once a week, you should pay more," said Stans.

"Maybe," said the reporter, "he takes a bath every night."

"That," said Stans, "might help society."

Auto Exhaust Research

The Eisenhower administration plans more research to cut down on automobile exhaust gases, the President's budget shows.

The budget asks an increase of $588,000 to a total of $4,900,000 in air pollution research and aid to the states. The increase will be used chiefly for research on auto exhausts.

Antitrust Activity Higher

The Eisenhower administration, which has been filing antitrust actions against oil and natural gas companies at a record rate, aims to keep up the pace in the coming year, it now appears. The budget of the President calls for a 6% increase in antitrust funds for the U. S. Department of Justice and a 7% increase for the Federal Trade Commission. Total for antitrust work by both agencies would be a record $7,848,400.

Both FTC and the DJ have so many cases in the works the courts and the FTC examiners are finding troubles processing them. A dramatic example came to light recently in the FTC's price discrimination case against the Pure Oil Co. at Birmingham, Ala. Examiner Robert L. Piper of the FTC told a resumed hearing that he has two weeks—starting next June 6—to finish up hearings in the case. If further time is needed, he said, it would have to wait until next year.

The DJ, too, is facing delays. In May, 1958, a federal grand jury at Alexandria, Va., returned an indictment against 29 oil companies on the grounds they conspired to jack up the price of crude oil and gasoline at a time of surplus supply.

Trial of the case began in February at the U. S. District Court at Tulsa, Okla., after a delay of nearly two years and is expected to last at least four months.

The government faces a tough job in proving its case. This is indicated by the government's main brief which stated that the proof depends upon "inference" rather than direct proof. The government pleaded for "extraordinary latitude in pleadings and proof." In response, Albert L. Nickerson, president of Socony Mobil Oil Co., said this is "one of the most unwarranted antitrust prosecutions on record."

DJ has admitted that it is looking into an Esso Standard Oil Co. plan for commission stations in Virginia and into Pure Oil Co.'s purchase of Woodley Petroleum Co., as possible new cases.

DJ does point to victories even without going through a trial. These include stoppage by threats of the Texaco-Superior and Sohio-Leonard merger proposals.

Pipeline Mileage Static

The construction of oil pipelines has been going on at a brisk pace during the past three years, but oil lines are being taken up almost as fast as new ones are being laid. As a result, the total at the start of 1959 was 189,982 miles, less than 1% more than the 188,540 mileage three years earlier according to a report by the U. S. Bureau of Mines entitled "Crude Oil and Refined Products pipeline mileage in the United States, January 1, 1959."

Capacity of lines has grown over the three year period, the report shows. Needed to fill the system Jan. 1, 1956, were 78,043,000 barrels; three years later the needed fill was 82,213,000 barrels.

The three-year period saw a total of 14,886 miles of new pipe laid, an average of 4,962 miles a year. A total of 10,649 miles of second hand pipe was laid, 3,549 miles a year. At the same time, 24,093 miles of oil line was taken up, 8,031 miles a year. There was a drop in the mileage of crude trunklines from 78,594 miles to 70,317 miles. Products pipeline mileage rose from 36,420 to 44,483 miles. Gathering lines also rose from 73,526 to 75,182 miles.

Haltom Heads New York Nomads

Hollis W. Haltom of Beckley, Haltom and Hickman, was elected president at the February meeting of the New York chapter of Nomads to succeed Don E. Kircher of Gardner-Denver Co., who was elected national regent. Other officers elected are: Maurice F. Delano, Jr., R. S. Stokvis & Sons, Inc., senior regent; W. E. Volkman, Cardwell Mfg. Company, vice-president; John D. Evans, Lucey Export Corp., secretary; John Davis, Mid-Continent Supply Company, assistant secretary; D. T. O'Connor, treasurer; T. E. Ramey, Continental-Emsco Company, assistant treasurer; R. L. Faris, Mission Manufacturing Co., sergeant-at-arms; Paul Nagle, Andreason-Lundberg Corp., and E. T. Landgraff, Chiksan Export Corp., assistant sergeants-at- arms.

Hollis W. Haltom, newly elected president of the New York chapter of Nomads (left) is congratulated by Don E. Kircher of Gardner-Denver Co., retiring president and newly elected regent.

Radiotelephone on Tanker

The Atlantic Refining Co. has installed a safety radiotelephone unit aboard the ATLANTIC ENGINEER. The company plans to equip all vessels with similar safety units in the near future.

Marathon Pipe Line Co. Organized

Marathon Pipe Line Co., recently incorporated as a wholly-owned subsidiary of The Ohio Oil Co. has taken over pipeline facilities and operations of the parent company, and a wholly-owned subsidiary, the Illinois Pipe Line Co. of Texas. Four operating divisions have been organized in the southwest, Rocky Mountains, Great Lakes and central states.

Buys Methane Interest

The Royal Dutch/Shell group of companies have bought a 40% interest in Constock International Methane, Ltd. pioneer in the trans-oceanic shipment of liquefied natural gas. The Methane Pioneer, first vessel to be fitted out for the service has delivered six cargoes to England since February, 1959. Continental Oil Co. retains a 40% interest and Union Stock Yard and Transit Co., 20%. The sale did not include the Methane Pioneer and certain onshore equipment.

CAMERON TREES ARE ON TOP...

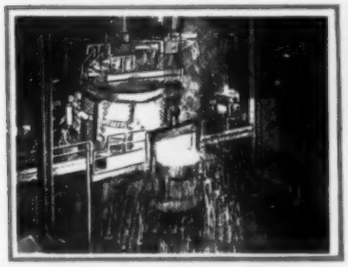
With safety, service and economy.

A Cameron Tree on top of your well means you are making the most of your investment. It means you are making possible top profits in production with safety.

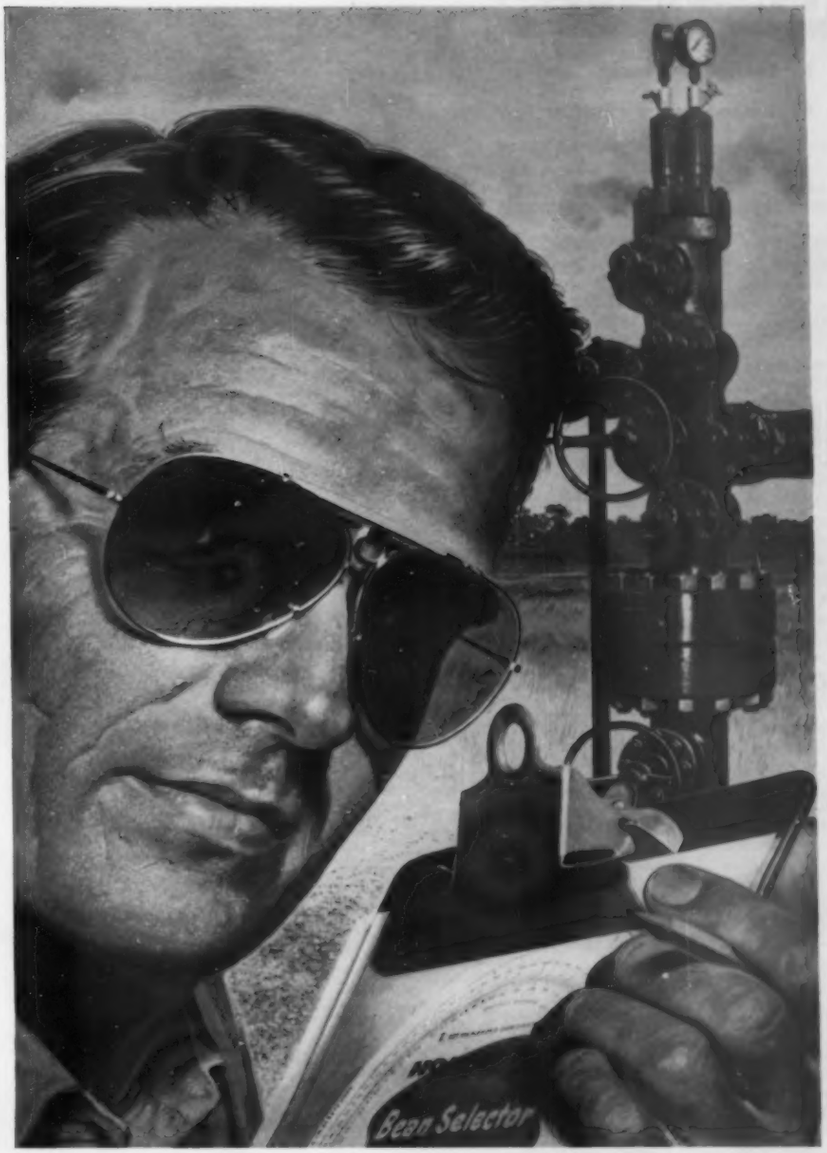
When you reach production zones – when the elements of drilling chance have been eliminated, doesn't it make good sense to protect your potential with the best completion equipment available?

Here's why Cameron Trees are your best buy:

SAFETY – Nothing is left to chance – we even make our own high alloy steel and forge it on presses designed especially for Cameron well head work. The most rigid inspection controls of the industry check every phase of manufacture and assembly.



SERVICE – In the field our trees do what they're supposed to do regardless of location, depth, pressure or type of flow. In ice, sand or salt spray – shallow or deep, high pressure or low, producing with abrasives or corrosives, hot or cold, in single or multiple completions, they can take it because they're designed and built that way.



ECONOMY – Almost 40 years of continuous design development experience goes into every Cameron tree. Controlling pressure and making possible the production of vast vital reserves is our business. The success of our customers all over the world means you too can get the most out of your well if you get a Cameron Tree on top.

HIGH EFFICIENCY
LOW INVENTORY
LONG LIFE
EASY MAINTENANCE
COMPACTNESS
EASY HANDLING

Cameron
IRON WORKS, INC.
P. O. Box 1212 – Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 76 Grosvenor St., London W. 1 England

LONDON LETTER

by Cecil W. Wood

Esso's Fawley-to-London Pipeline

Esso Petroleum Co. is seeking planning permission to lay a 75-mile, 10-inch pipeline from its Fawley refinery to a new 575,000-bbl distribution depot on a 50-acre site near London Airport.

Initial line capacity will be 43,000 b/d and all grades of light products will be transported, making it the first large-scale commercial products line in the UK. Distribution from the depot will be by road over a wide area, including all west London, but aviation fuels will be delivered into London Airport by special pipelines.

A bill is being drafted for presentation to parliament to secure any powers necessary for compulsory land purchase and it is hoped to start work this year, with completion early 1963. Construction will be a major operation and, apart from passing under Southhampton Water and the Thames, will involve a number of main road, rail and canal obstacles.

At present products are brought from Fawley to Purfleet on the Thames in 16,000-ton tankers and thence up river in smaller vessels to Fulham and Hammersmith for London distribution—a distance of about 225 miles. Esso believes pipeline transport will be much cheaper and is also bearing in mind the possibility of extending the new line later to Birmingham as a distribution center for the midlands.

Higher Revenue from Oil Taxation

The UK exchequor secured £346.1 million in revenue from hydrocarbon oil duties in the year ended March 31, 1959, according to the latest report of the commissioners of customs and excise. This compares with £321.8 million in 1957-58, a year reflecting the restrictions ensuing from the Suez Canal closure, and £337.9 million in 1956-57. The average annual yield in the five years to March 31 last was £326.8 million.

Motor spirit and diesel engine road fuel accounted for 97.5% (£337.5 million) of the above 1958-59 total and, except for the "Suez period"—when it was temporarily raised to 3s. 6d.—the duty has been 2s. 6d. per imperial gallon since March 1952.

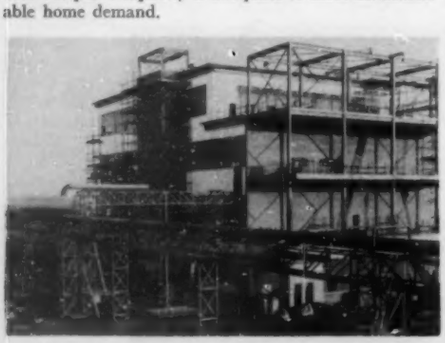
ICI Petrochemical Developments

The 10,000-ton/year polypropylene plant at Wilton will be on stream towards the end of 1960, well ahead of schedule. Excellent progress is also reported in the accompanying project to make the organo-aluminum compounds in bulk for use as catalysts in the process.

Pilot plant samples of this new "Propathene" plastic, made under Montecatini and Montecatini/Ziegler UK patents, have been successfully evaluated for a wide variety of applications.

Improvements in efficiency and cost in polyethylene operations are being passed on to the consumer, and the standard UK price of "Alkathene" was reduced 3d/lb in January to 2s 3-½d. Polythene output will be raised about 15% this year, to around 105,000 tons a year.

The company's Billingham acrylonitrile plant has completed its trials and went into large scale production as scheduled before the end of 1959. Output will go partly into making ICI's "Butakon" synthetic rubbers but plant capacity is adequate to meet all foreseeable home demand.



Progress on the I.C.I. Plastics Division's "Propathene" plant at Wilton, North Yorkshire.

UK 1959 Oil Imports and Exports

Crude oil imports into the UK in 1959 rose 41,908,000 bbl (16.8%) over 1958 to a new high level of 291,633,000 bbl (799,000 b/d) and total crude and refined oils rose 55,046,000 bbl (16.6%) to a new high of 386,891,000 bbl (1,060,000 b/d). The proportion of crude was practically unchanged at 75.3%. Although Middle East crude rose 24,034,000 bbl, its share of total imports fell to 59.2% from 61.7%. If the 1959 statistics were more complete, it would be seen that Nigerian crude imports were about 3,835,000 bbl (value £4.1 million) against 752,000 bbl (£0.8 million) in 1958. Some details of imports and exports are shown in the accompaning table.

UK OIL IMPORTS AND EXPORTS

	Quantity in 1,000 bbl.		Value in £ million	
	1959	1958	1959	1958
IMPORTS				
Crude and partly refined oil				
Eastern Hemisphere:				
Middle East	228,897	204,863	239.5	235.8
Far East and Australasia	4,338	1,479	6.1	2.3
Europe	737	1,524	1.6	2.6
Africa	—	752	—	0.8
Total	233,972	208,618	247.2	241.5
Western Hemisphere:				
Latin America	51,780	40,665	59.3	52.3
North America	403	442	0.7	0.8
Total	52,183	41,107	60.0	53.1
Unallocated	5,478†	—	6.4†	—
Total crude	291,633	249,725	313.6	294.6
Refined oil				
Motor spirit	25,036	20,607	47.1	40.1
Spirit, other than motor spirit	983	1,031	2.3	2.5
Kerosine	10,406	8,967	18.2	15.1
Lubricating oil	4,403	2,873	12.1	9.5
Gas oil	15,869	14,955	25.9	24.2
Diesel oil	1,741	631	2.7	1.0
Fuel oil	36,817	32,993	37.9	37.0
Other heavy oils	‡	62	‡	0.3
Total refined	95,258	82,120	146.2	129.7
Crude and refined	386,891	331,845	459.8	424.3
EXPORTS				
Total liquid products	57,225	59,187	87.6	93.2
Re-exports	3,167	2,925	4.7	5.2
Bunkers (foreign trade)	27,458	25,769	—	—

Notes: †Other Commonwealth and Irish Republic, 3,835,000 bbl (£4.1 million). Other foreign, 1,634,000 bbl (£2.3 million). ‡Includes "Other heavy oils" in 1959.

H. E. Barry

N. L. Dickinson

Honors for British Oil Men

The New Year's Honors List conferred distinctions on a number of British oil men. The rank of Commander of the Most Excellent Order of the British Empire (CBE) was conferred on Steriker Norman Hare, lately general manager of Khanaquin Oil Co., and the rank of Officer (OBE) on Harold Edward Barry, manager of Shell-Mex and B.P.'s trade relations department, and Percy Hyde, engineer commodore of the S.S. "British Robin," BP Tanker Co. Membership of the Order (MBE) is conferred on John Victor Jones, chief information officer at BP's Kent refinery, and Hugh Milne, chief engineer of the M.V. "Athelcrest," Athel Line.

The British Empire Medal is awarded to Arnold Edward Fitzgibbon, donkeyman of Shell Tankers "Vitrinia," H. G. Jarvis, chief stillman of Carless, Capel & Leonard Ltd., and Charles Bernard McCartney, chief steward of BP Tanker Co.'s "British Officer."

Appointments in Construction Firms

C. E. H. Verity, OBE, has become managing director of Foster Wheeler Ltd. following the resignation of G. H. Hopewell. Mr. Verity will continue as manager of the steam division, R. B. Kerr, MBE, has been appointed deputy managing director and also manager of the process plants division. Mr. Hopewell remains a director and becomes deputy chairman. H. T. Collinswood has retired as manager of the process plants division but remains a director.

Norman L. Dickinson has been appointed manager of process engineering for Kellogg International in London. Previously a technological engineer with Shell Oil Co., Mr. Dickinson joined Kellogg in 1940 and in recent years has been manager of the refinery plans division in New York.

In honor of his 25 years' service as head of the British organization, Harry McEvoy was elected chairman of Kellogg Co. of Great Britain. He will continue as managing director.

SBP Plant at Kent Refinery

British Petroleum will install at Kent its first UK plant for the production of special boiling plant solvents. The capacity will be 30,000 tons/year and completion is scheduled this year.

Oil Production in Dorset

BP Exploration Co.'s discovery well near Kimmeridge in Dorset, recently under a production test, yielded an average of 40 tons/day of 44 API crude from limestone at 1,800 ft. About 2,000 tons were collected for processing and testing.

Drilling is proceeding on a second test well 2,500 ft west of Kimmeridge No. 1, and one or two more wells are planned. BP said considerable work is still required to prove commercial possibilities.

Giant Fueler for Jet Aircraft

In service now at London Airport is the first of five "Severn Super Fuellers" for jet aircraft, to be used by Shell-Mex and B.P. With delivery capacity of 750 gal/min and maximum loads of 10,000 gal each, a pair of "Severns" could fuel the largest inter-continental aircraft now using the airport.

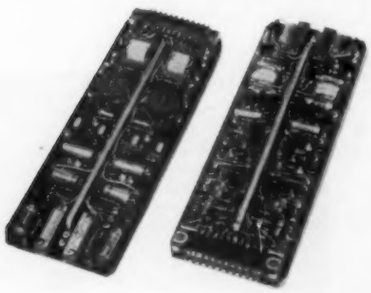
Electronic Computer for BP

An electronic computing system has been ordered by British Petroleum from Ferranti Ltd. at a cost of over £250,000. This will be used in the London office for data processing covering a wide range of operations in the commercial and scientific fields.

FM PORTABLE

Future methods demand Hi Fidelity Full Spectrum FM Magnetic Recordings!

TRANSISTORIZED
MINIATURE MODULES



With the recent miniaturization of FM modules, more Geophysicists now specify the full spectrum SIE FM Recording System "RecorData" — the only *low power-drain* all-purpose system for refraction, conventional and high-resolution seismic recording.

In addition to the latest advancement in portability, the new "RecorData" (PMR-20) gives you:

- **System performance not dependent on tape quality.**
- **No modulation noise.**
- **Wide frequency response (1 to 500 cps).**
- **Negligible phase shift from 5 to 500 cps.**
- **A complete recorder in two packages.**

Write for free brochure.

SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO.
A DIVISION OF DRESSER INDUSTRIES, INC.
10201 Westheimer • P. O. Box 22187 • Houston 27, Texas • HOmestead 5-3471
CABLE: SIECO HOUSTON TWX: HO-1185

MEXICO
SIE Mexico
La Fragua No. 13-201
Mexico 1, D.F.
Phone: 21-57-87

CANADA
Southwestern Industrial Electronics (Canada) Limited
5513 Third Street S. E., Calgary, Alberta, Canada
Phone: Chestnut 3-0152, 3-0937, 3-0964, 3-6922

EUROPE
SIE Division of Dresser AG
Mühlebachstrasse 43, Zurich, Switzerland
Telephone: 32 84 87/89 • Telex: 52 6 83
Cables: Dresserzur Zurich

VISIT OUR GEOPHYSICAL
SERVICE CENTER

Synthetic Rubber Expansion

Work has started on increasing the annual capacity of International Synthetic Rubber Co.'s plant at Hythe (Hampshire) from 70,000 to 90,000 tons a year. Work is also proceeding satisfactorily on a 2.5 million gal/year rubber latex plant.

Although Hythe bulk production only started in 1958, this early expansion reflects the appreciation by manufacturers of the products made and the rise in UK consumption, of solid styrene/butadiene rubbers. The 1959 figure is estimated at 60,000 tons, against 45,000 tons in 1958.

British Pipe for Esso in Libya

South Durham Iron & Steel Co. has received a £1,430,000 contract from Esso (Libya) to supply about 100 miles of 30-in. pipe, totaling 23,000 tons, to carry crude from the new Zelten oilfield to the Mediterranean. Deliveries are to be completed by September.

The company is now carrying out important contracts for steel pipe for Iraq Petroleum and has recently started fabricating orders for 23,350 tons from Shell for Indonesia and 13,000 tons from British Columbia Electric Co. for Vancouver. Another order, 58,500 tons of pipe, was shipped recently to YPF Argentina.

Pacific Steam's First Tanker

The first tanker of Pacific Steam Navigation Co.'s fleet, the 46,000-dwt "William Wheelwright," launched in January, is also the largest so far built by Harland & Wolfe Ltd., Belfast. It will be chartered to Shell Tanker Co. The H & W propelling machinery consists of a single screw arrangement of double reduction articulated type geared turbines developing 16,000 SHP in service. Steam at 600 psi working pressure and 900 F at the superheater outlet will be generated by two Babcock & Wilcox "Selectable Superheat" water tube boilers of builder's make.

Trend of Steel Tube Orders

No company's order book gives a better general reflection of British oil-industry requirements of steel tubes than does that of Stewarts & Lloyds Ltd., whose chairman—A. G. Stewart—said recently the financial year ended October 3, 1959 had been a most disappointing one for their trade with the oil industry. The tonnage of steel tubes despatched, 151,000 tons, was 41% down from the previous year.

Plant and equipment for making extreme line casing, special casing joints and drill pipe at the Clydesdale works are well advanced and operations are planned to start in a few months. Other developments: operations have started on a new extrusion plant for small diameter seamless pipe, a pipework engineering division has been established, and facilities extended to make spun iron pipe up to 48-in. diameter.

New Lubricant for Ships' Gears

Extensive study by "Shell" Research at Thornton of the lubrication requirements of ships' case-hardened reduction gears during the critical running-in period has led to the development of a lubricant with higher load-carrying capacity than is provided normally by turbine oils. It not only prevents damage during running in but its chemical polishing action speeds up this critical phase, after which normal turbine oils can be used. The new lubricant is now in extensive use in merchant ships for both running in and acceptance trials.

Growth of LPG Sales in UK

The UK market for liquefied petroleum gases in 1958 was nearly 90,000 tons, according to Horner and Jarvis (Shell International Petroleum) and Turner (Shell-Mex and B.P. Gases) in a survey of the present and future. Sales have doubled since 1954 despite the widespread availability of town gas and electricity, and overall industrial sales were increasing particularly fast; including feedstocks to gasworks, industrial sales represented 35% to 40% in 1958 and gas boards are confidently expected to take LPG from UK refineries at considerably increased rates.

The authors expect the recent growth in total sales to be more than maintained and estimate that the tonnage of LPG sold in the UK and Eire should approximate 250,000 tons a year for all outlets by 1964.

The application of LPG to industrial engines was demonstrated recently at a Birmingham exhibition organized by Shell-Mex and B.P. Gases in conjunction with makers of fork lift trucks, and the like, which showed the ease of adapting conventional engines to LPG operation by conversion kits.

Appointments

G. W. POWELL, a member of the Esso Petroleum board since 1957, has been appointed a managing director.

G. W. Powell

B. R. Fraser

B. R. FRASER, manager of Mobil Oil's Coryton refinery since its start, has been made manager of the new manufacturing department at the head office in London which will coordinate the work of the refinery, the Wandsworth blending works, and the Birkenhead blending works and grease plant. **J. W. BARTHOLEMEW,** assistant refinery manager, succeeds Mr. Fraser as manager, and **C. E. BEAN,** operating superintendent, becomes assistant refinery manager.

S. G. READ, Eagle Oil & Shipping Co. marine manager, has been made a director of Shell Tankers on the merging of the Eagle and Shell tanker fleets.

W. L. BAXENDALE has been appointed a director of London and Coastal Oil Wharves.

H. H. CHANDLER has been appointed a director of Regent Oil Co. and **R. WALTON BALL** has retired from the board.

M. A. E. HODGSON has been appointed development manager of the heavy organic chemicals division of Imperial Chemical Industries.

Monsanto Chemicals announces the appointments of **W. H. RITCHIE** as development manager-projects and **N. G. H. THOMAS** as development manager-products, both posts being under J. M. Kershaw, director of development and market research.

CURTIS M. KLAERNER has been appointed a director of Mobil Oil Co. in place of Arthur L. Lancton, who has resigned.

K. W. SIMS, sales manager of Castrol Oils Inc. in New York since 1957, has returned to the London headquarters of the Wakefield Castrol group on his appointment as export promotion manager.

J. R. SPEIRS, general manager of Steel Brothers & Co., has been appointed a director of Burma Oil Co. (1954) Ltd. to succeed W. Hutchinson, who has retired.

J. C. FITZGERALD and **H. WILLIAM SLOTBOOM** have been appointed directors of Bataafse Internationale Petroleum Mij. and Internationale Research Mij, respectively.

British Equipment Notes

The new type rail cars introduced by Mobil Oil Co. were referred to in the December issue (p. 10) as having "Emsco" valves in place of the customary filling points. These are, in fact, "Emco-Wheaton" valves, made by *Emco Brass Mfg. Co. Ltd.*, of Margate—a modification of its standard B. 451 emergency valve for safely carrying petroleum in vacuum brake trains at up to 50 mph average speed. Special features are absence of a shear groove and incorporation of an "O" ring in the flange to prevent loosening by vibration.

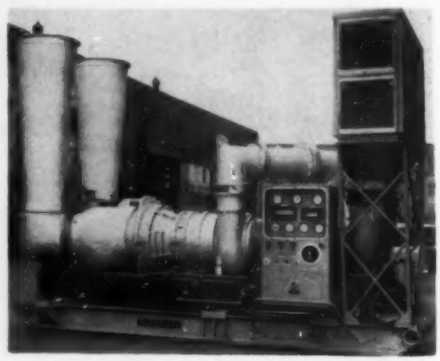
In order to obtain greater uniformity within the Stone-Platt Industries group, the major marine interests have been segregated from the general foundry interests. The former now come under the control of *J. Stone & Co. (Propellers) Ltd.*, 1A Cockspur Street, London, S.W. 1.

Two recent developments concern expansion of the overseas activities of the *Leyland Motors* group—Leyland Motors Ltd., Albion Motors Ltd. and Scrammell Lorries Ltd. Full-scale marketing and servicing of diesel trucks in the US is to be carried out by a new company, Leyland Motors (U.S.A.) Inc., which will be a subsidiary of and administered by Jaguar Cars Inc., New York. A dealer organization is being appointed and a factory parts depot established in Long Island City. The second expansion concerns Spain, where a substantial share holding has been purchased in Empresa Nacional Automamiones SA, makers of the well-known Pegaso commercial vehicles. It is anticipated that the market for these will be considerably expanded outside Spain.

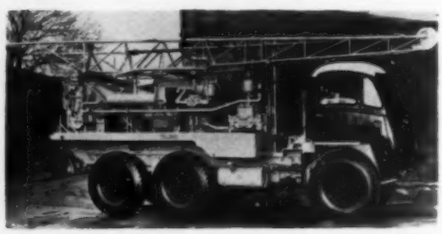
The English Electric Co. Ltd. announces a new range of totally-enclosed, fan-cooled motors which are smaller, lighter and cheaper than existing motors of the same type, though having the same dimensions as the 'C' type ventilated motor. Termed type 'D,' they have outputs up to 100% greater than existing motors of the same size.

Elliott-Automation Ltd., is negotiating with Manufacture de Machines du Haut-Rhine SA (Manurhin), of Mulhouse, with a view to arranging to fabricate automation equipment in France. The present proposal is that the company will take a financial interest in Manurhin.

Powell Duffryn Engineering Co. Ltd. has acquired the entire share capital of Pipeweld Ltd., of Manchester, a company which has specialized for many years in pipework for the oil industry. This alliance enables PDE to undertake comprehensive oil installations as integrated projects as well as long-distance pipelines.



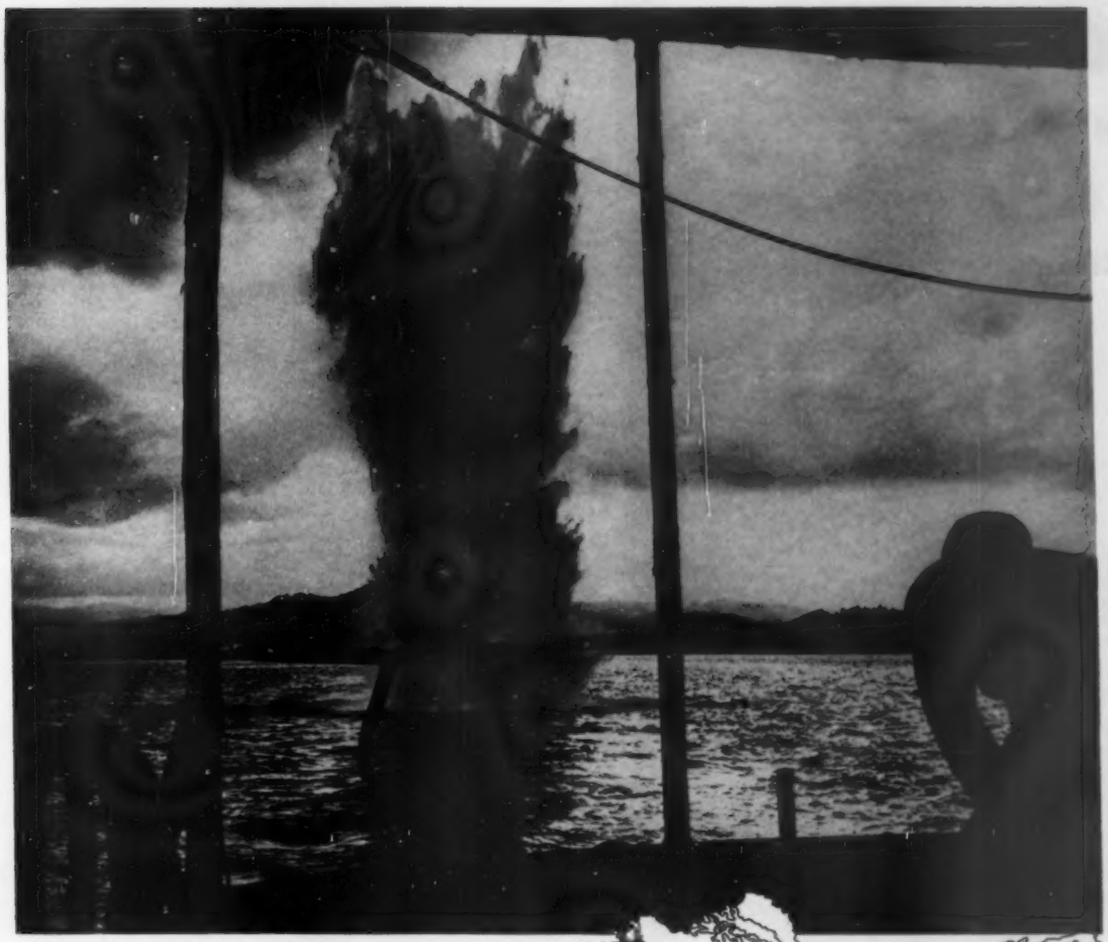
The first two *Ruston & Hornsby Ltd.* 'TA' gas turbines to be skid-mounted will soon be pumping crude through an Iranian Oil Services' pipeline. Such added strength and rigidity is given by the 17 ft long by 3 ft 3 in wide skid in conjunction with the standard bed frame that it will be bolted to concrete only 6 in thick. The complete assembled installation is 9 ft wide and 12 ft high to the top of the exhaust diffusers and the weight only 18,000 lb for an output of 1,260 bhp.



A special feature of the consignment of "Nubian" cross-country vehicles carrying 6x6 rigs completed recently by *Transport Equipment (Thornycroft) Ltd.* for Seismograph Service (England) Ltd.'s overseas contract work is the tire equipment. Michelin 'X' 14.00-20" sand tires are fitted all round, the largest so far on any of these vehicles. A high degree of flotation for desert tracks is claimed. The vehicle is equipped with a rig made by Failing Supply Ltd., London.

Erratum

In the London letter of December 1959 mention was made of the special valves employed by Mobil Oil on a new fleet of tank cars operating between Coryton and Coventry. The valves were manufactured by Emco Brass Mfg. Co. Ltd., Margate, Kent, under the brand name "Emco-Wheaton." Due to a typographical error the valves were referred to under the name "Emsco."



Western Conducts More Marine Seismic Surveys Than All Other Contractors Combined!

Every year since 1954, Western Geophysical Company boats have done well over half of ALL contract offshore seismic explorations in the world.

This record reflects the considered judgment of many of the most respected people in the petroleum industry on the competence of Western men, techniques and instrumentation. When you consider your next geophysical survey, let us tell you more about the Western services that have earned and held such confidence.

Western Gravity crews have conducted highly successful explorations in the waters of both hemispheres. Western's land seismic parties are at work on four continents.

Western
GEOPHYSICAL COMPANY
AND ITS AFFILIATES

Principal Office: 523 WEST SIXTH STREET · LOS ANGELES 14, CALIFORNIA

AFFILIATE AND REGIONAL OFFICES THROUGHOUT THE WORLD

'TOPANOL'
ANTIOXIDANTS
for gasolines and hydrocarbon liquids

low cost
low concentrations
less deposit formation
high activity
colour stability
chemical stability
long-term stability

Range of five—

'Topanol' A
'Topanol' O
'Topanol' AN
'Topanol' M
'Topanol' OC

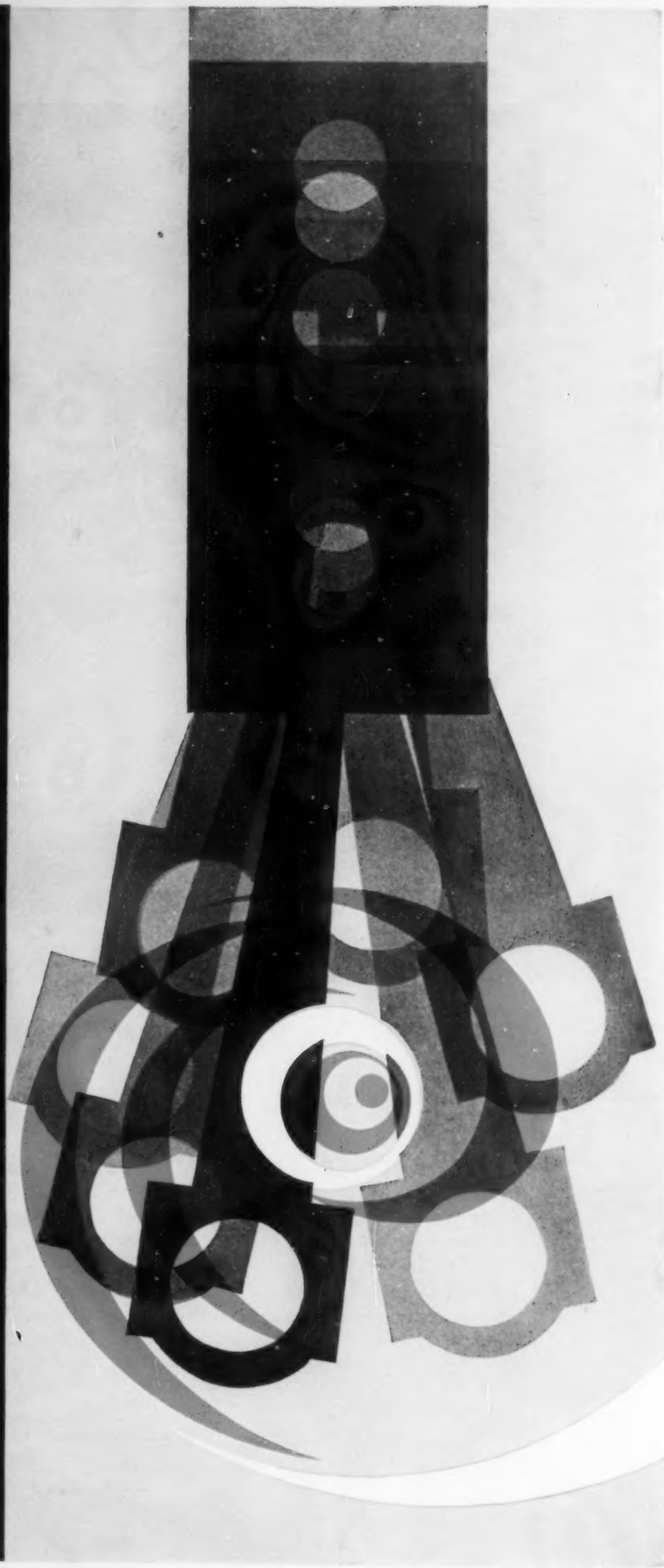
—we can help you choose from these the best antioxidant for your purpose

PRODUCTS OF I.C.I. HEAVY ORGANIC CHEMICALS DIVISION

Full information on request

IMPERIAL CHEMICAL INDUSTRIES LIMITED
LONDON, S.W.1. ENGLAND

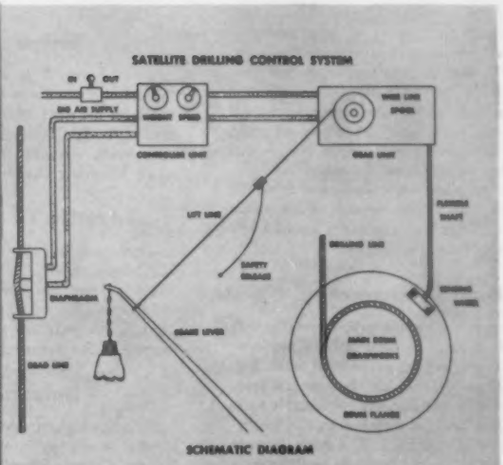
ICI

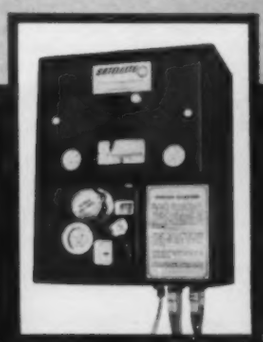


FOR FASTER, STRAIGHTER DRILLING

Straighter hole drilling with a steadier rate of penetration through all types of formations is assured with the Satellite All-pneumatic Automatic Drilling Control. The 2 speed Satellite Automatic Drilling Control has a rate of penetration range from zero inches per hour to hundreds of feet per hour.

The Satellite Drilling Control provides precise, preset weight control on the bit and is safer and simpler than other known drilling controls. The driller can always trust the job of control to the Satellite.





THE *SATELLITE* AUTOMATIC DRILLING CONTROL

- accurately maintains weight on bit
- simple and safe
- positive and convenient

OTHER SUPERIOR FEATURES OF THE SATELLITE

• More positive and more convenient than units operating on drilling lines or protruding from the front of the draw-works. • Dismantling is not required during trips. • Connection by flexible shaft to the Gear Unit gives faster, more accurate response.

For complete and detailed information send for the Lucey Satellite Bulletin.

LUCEY *Export*

LUCEY EXPORT LIMITED

Broadstreet House, London E. C. 2, England

•

LUCEY EXPORT INTERNATIONAL, S.A. Apartado 6718, Panama City, Panama

INTERNATIONAL NEWS AND NOTES

Japanese To Develop North Sumatra

Officials of the State company Permina have announced that, under an agreement with a Japanese group for oil development in northern Sumatra, Japanese will extend a $50 million credit to Permina, repayable in 10 years on the basis of 40% of all new production above current levels. The agreement calls for rehabilitation of 220 previously developed oil wells and the drilling of 250 new wells, with restoration and expansion of the Pangkalang Brandan refinery. New production is to be sold to the Japanese at world market prices. Permina's holdings consist of six small fields, one of which (at Rantau) produces about 85% of current output of the refinery.

Sahara Hunt By Germans

A second West German oil company, Gewerkschaft Elwerath, is reported to have entered Sahara exploration, Elwerath has concluded an agreement with Ste. de Recherches et d'Exploitation de Petrole (Euraf-rep) for a 20% interest in the French company's 625-square-kilometer permit at Tan Emellel in the southern Sahara near the Edjele oil field. The government-controlled investment company Petropar will have a 10% interest.

Exploration In Aden Protectorate

The Iraq Petroleum group is negotiating for a more permanent and long-term exploration agreement over parts of the Aden protectorate covering the sultanates of Quaiti and Kathiri. This would replace the current short-term permits for geological and seismic surveys, which have indicated regions worthy of closer investigation and exploratory drilling.

Geological Information Exchange

QUPEX, the Queensland Petroleum Exploration Group, recently formed to promote exchange of information and to foster exploration in the Great Artesian Basin of Queensland, has announced the election of its first officers. They are: J. J. Tanner (Phillips Petroleum), chairman; D. M. Traves (Mines Administration), vice-chairman; H. I. Harris (Magellan Petroleum), secretary-treasurer.

Senegal Oil Strike

French sources report the first oil strike in Senegal following a long program of exploration by French and USA firms. It is 20 miles east of Dakar in the Sebikotane region.

Japan To Import Baku Crude

Asia Sekiyu Co. has signed a six-year contract with Russia for the importing of 1½ million tons of Baku crude. Amount to be imported in first year is 160,000 to 170,000 tons (3,200 to 3,400 b/d) at $14.75 per ton (below prevailing prices). Prices for subsequent years are to be negotiated. Asia Sekiyu is an independent refiner with a 13,000 b/d refinery.

Syria To Build Coastal Refinery

A report from Damascus states that Syria's 10-year oil development program includes $44.8 million for a 10,000 b/d refinery on the coast.

Indonesia Acts To Up Refining

Indonesian Minister Djuanda has informed parliament that oil companies have been issued instructions for improvement of their marketing and refining facilities for domestic oil consumption. Cost is to be covered by the recent rise in Indonesian oil prices. Companies include Caltex, Standard Vacuum, Shell, and the Indonesian companies. Caltex is to build a refinery in central Sumatra by 1961.

40,000-Tonners For USSR

The Soviet tanker fleet in 1960 will have its first super tankers of 40,000 tons. The first vessel, the "Peking," was launched at the Baltic shipyard in Leningrad in December 1959. The "Warsaw" and "Budapest" are nearing completion. All three will be put in service this year.

Soviets Drill Twin Holes

Twin holes, 5 ft apart—of which one is vertical, the other directional—are being drilled at Kirovabad, the new oil area of Azerbaijan. Both holes are to be drilled to 18,000 ft working on the pendulum principle—one machine lifting the tool out of one hole while lowering the tool into the other.

Austria To Spend $29.5 Million

The Austrian State company OeMV will invest $29.5 million in 1960 against $21.4 million in 1959. $19.2 million has been earmarked for the processing industry (1959: $10.4 million). Scheduled for completion this year are the distillation unit and the Platformer of the Schwechat refinery.

Bulgaria Buys Tankers

Bulgaria announced it will buy a 20,000-ton tanker in the West, to run Soviet crude to its refineries. Recently it purchased for $326,000 the Swedish 2,050-ton "Ingegard Reuter," now named "Komsomolets." After completion of the 20,000 b/d refinery at present building at Burgas, crude movement from Soviet Black Sea ports to Burgas and Varna will rise steeply.

Oil Found In Western France

Essorep, Standard of New Jersey subsidiary, encountered oil in a well in the Cazaux region of western France. Cazaux No. 5 reached 8,193 ft in January in oil-impregnated marls and sandstone; the well is to be put into early production.

U. K. Firm Must Pay Damages

The Full Supreme Court of New South Wales dismissed a British shipping company's appeal against a court order to pay damages caused by an oil fire.

The shipping company is the Overseas Tank Ships (U.K.) Ltd. In October, 1951, furnace oil escaped from a company tanker and spread over part of Sydney Harbor. Two days later the oil caught fire and extensively damaged a wharf owned by Mort's Dock and Engineering Co. Ltd. The fire was started by molten metal falling from a welding operation on the wharf.

Mr. Justice Kinsela found the owners of the ship guilty of negligence.

USSR Refinery Construction

Construction has begun on a refinery at Polotsk, Byelorussia, USSR, which will process Bashkirian crude, piped through a 1,240-mi. line from Kuybishev. The plant's distillation units are thermal and catalytic cracking facilities are to be completed in 1963. Petrochemical plants are to be erected nearby. At the Omsk refinery, the second catalytic cracking plant has been completed.

Two Workers Shot

Two American construction workers employed by Collins Submarine Pipelines Overseas Ltd. working in Fao, Iraq were shot Jan. 9 by a recently discharged disgruntled Iraqi employee. Both are reported in good condition at Republic General Hospital in Basra. The two men are Paul Todd of Sulphur, La., and Robert Stiles, of Houston.

Algerian LPGas Tanker

A small propane tanker, with eight tanks totaling 920 cubic meters capacity, has been placed in service on a Metropole to Algeria run, it is announced.

Rene Boudet, president-director general of the Societe Gazocean, said the liquefied gas tanker has a "promising" future. The ship, he said, is the prototype for future larger tankers to carry propane and also those to carry methane and the 20 billion cubic meters of the Sahara reserves to Europe. This is the first tanker to use refrigeration produced by the gas itself. The tanker is the "Descartes" built by Chantiers Navals of La Ciotat for Societe Gazocean.

C. S. I. Names Representative

Computer Systems, Inc., New York City, N. Y. has appointed Robert Graanstra, I.R.C.A., Voorburg, Holland, as European sales representative for its line of analog computers, DYSTAC computers, simulators and accessories and components. The new representative will provide sales coverage for the Netherlands, Belgium and Luxembourg.

Faster Bunkering At Aden

To reduce bunkering time for the large passenger-vessels being built to reduce the UK-Australia journey by about a week, BP (Aden) Ltd., is establishing two new fast bunkering terminals in Aden harbor. Two 16-in. lines, each 2,800 feet long, are being laid in the harbor and two new 1,500 tons/hour fuel oil pumps are being installed at Steamer Point. Facilities will include two floating barges with electric cranes for lifting the heavier pipeline terminals to the ships.

Good Shell-BP Progress In Nigeria

The Shell-BP Development Co. of Nigeria estimates oil production this year should be at least 30,000 b/d (about 1,500,000 tons/year), against the 1959 average of 15,000 b/d. During 1959 the company drilled 34 exploration wells—7 produced oil on short tests and 27 were dry—and also 16 successful appraisal wells.

Shell Exploration In Belgium

Bataafse Petroleum Mij. has applied to the Belgian government for an oil and gas exploration permit covering an area of about 650,000 acres in southern Belgium comprising the southern part of Hainault province, the center of Numur province, and the western parts of Liege and Luxembourg provinces. If granted, the rights will be assigned to Belgian Shell or to another Belgian company which would have the full support of the Royal Dutch/Shell group.

Israel To Export Products

Negotiations are under way with American investors for modernization of Haifa's oil refineries, built in Israel in 1938 by British Petroleum Co. and purchased in 1959 by the government and a private firm. Israel is expected to become an early exporter of refined oil products for the first time since the Iraq-Haifa pipeline was closed 11 years ago.

Saudi Arabian Oil Deliveries

Tapline crude deliveries from Sidon, Lebanon, averaged 336,394 b/d during 1959, down 31,655 b/d from average 1958. December deliveries averaged 315,295 b/d, down from 349,082 b/d in December 1958.

Netherlands' Third Refinery

Parts of the third refinery in The Netherlands, the 90,000 b/d plant begun by Esso in May 1958 at Rotterdam, were ready for testing the end of January; others will be ready in April.

Timor Well Suspended

Timor Oil Ltd. has suspended drilling at its Ossulari No. 1a well at 4,600 ft. A zone fossilliferous limestone was encountered, of low porosity and permeability, possibly caused by a nearby fault zone. Further drilling at the site is under consideration.

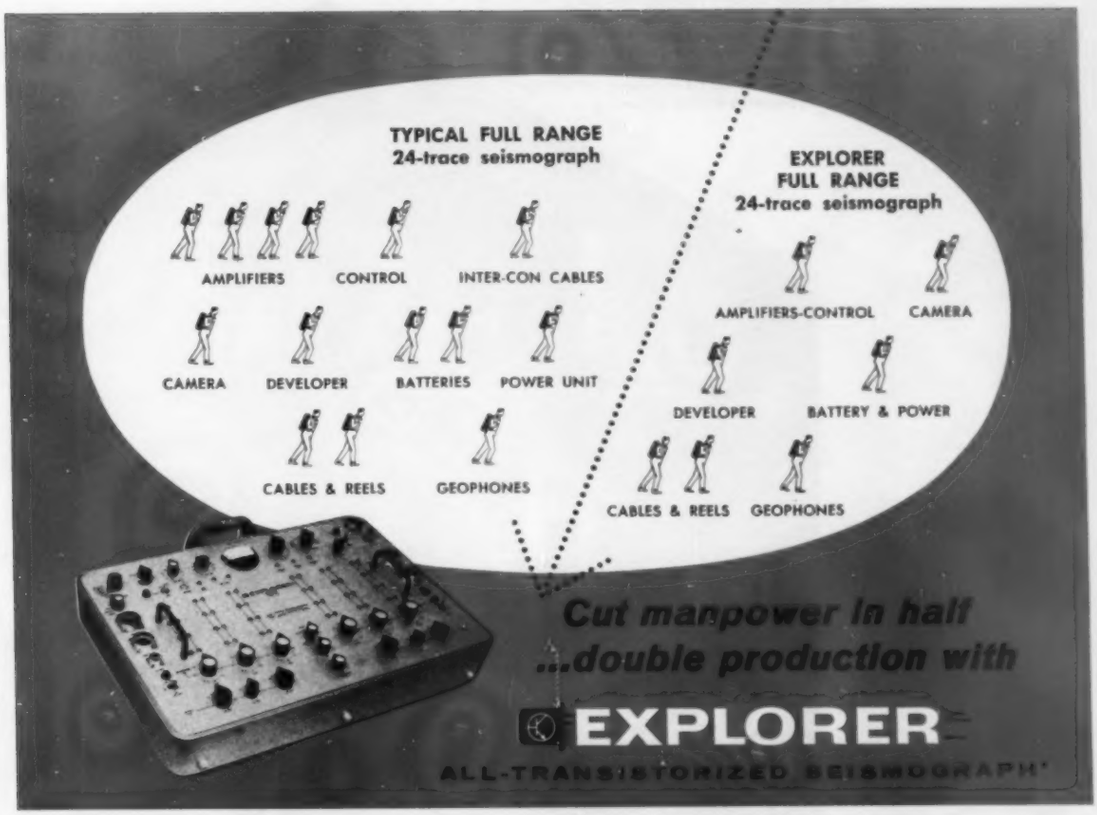
Germany Cuts Gas Prices

Gasoline price cuts all over West Germany and West Berlin range from US 0.9¢ to 2.7¢ per gallon. New regular-grade price will be 52.8¢ and high-octane 64¢ per gallon, throughout the republic and West Berlin.

Mobil Gets Tunisian Permit

Mobil International Oil Co. has acquired a 50% interest from SEREPT (Ste. de Réchérche ed. d'Exploitation des Pétroles en Tunisie) in a 10-million-acre exploration permit in the southern half of Tunisia, about 200 miles from oil production in the nearby Algerian Sahara. SEREPT will be the operator. This move followed close on the heels of the recent announcement that Mobil's French affiliate had signed a preliminary agreement with Cie. d'Exploration Petroliére et al. for a 25% interest in oil rights in Algeria on eight million acres.

(*Continued on page* 16)



In some of the world's toughest assignments, the EXPLORER Model 8000 24-trace All-Transistorized Seismograph has effected reductions in recording personnel of 50 percent from the number required for the typical full range portable systems. Due to the reduced weight and number of packages for amplifiers, batteries and interconnecting cables, only seven men are required for the 8000 system. In foreign operations, the additional savings in manpower will be several times the number of packages eliminated due to release of support personnel.

Of most importance, it is reported that the decreased time involved at and between each recording set-up with the EXPLORER Seismograph has approximately doubled production, and, of course, cut the cost per profile in half.

Furthermore, the 8000 system is effective over a wide range of frequencies, from high resolution to refraction. You have a wide selection of AGC fixed and TVG gain controls.

The EXPLORER is the only completely *field-proved* All-Transistorized Seismograph System. Let the TI engineer show you how it pays for itself in *reduced operating costs, increased production, and unequalled reliability.*

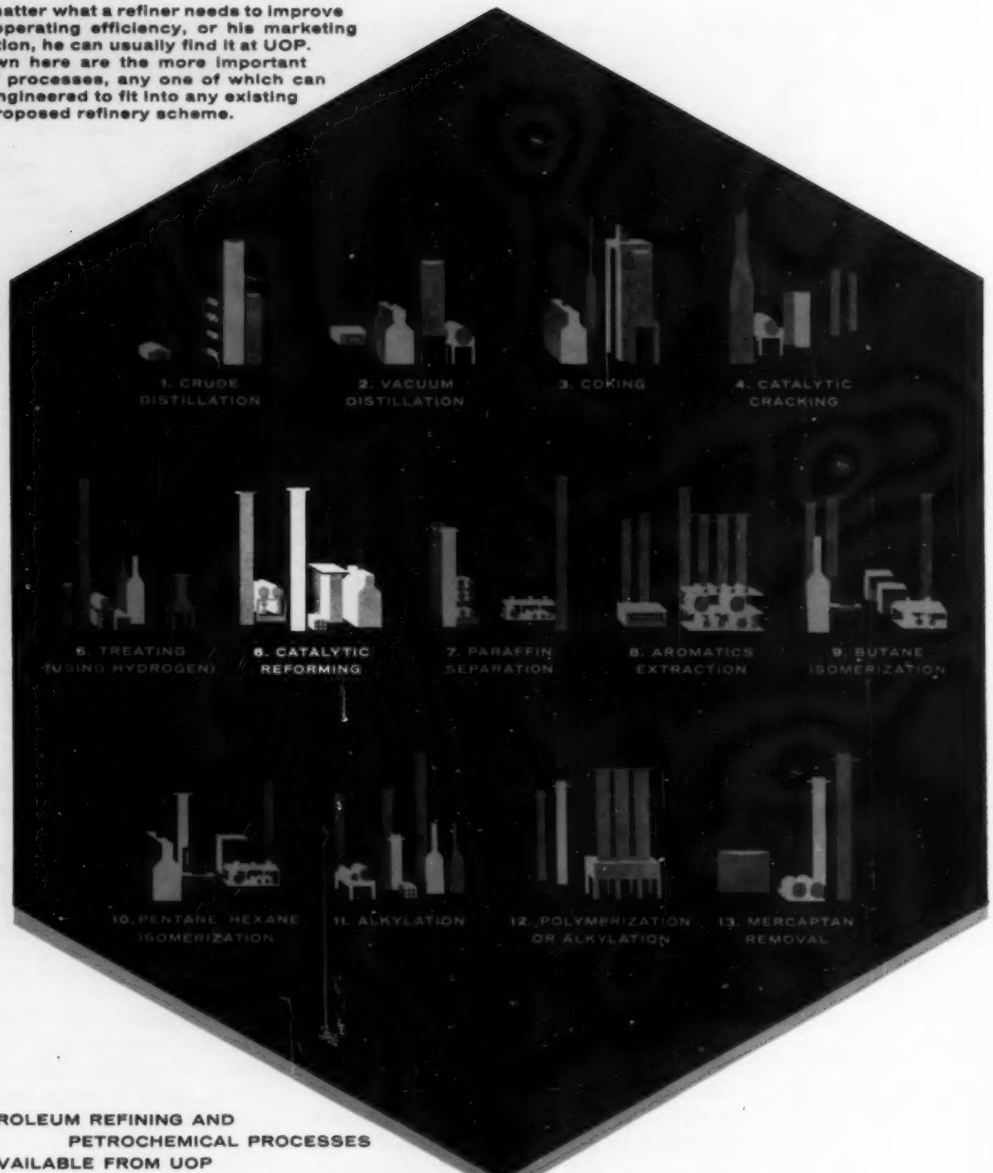
Now operating in Sumatra, Peru, Colombia, Mexico, France, Canada and South Louisiana.

Write for Bulletin No. S-324

TEXAS INSTRUMENTS
INCORPORATED
GEOSCIENCES & INSTRUMENTATION DIVISION
3609 BUFFALO SPEEDWAY • HOUSTON 6, TEXAS • CABLE: TEXINS

3-33

No matter what a refiner needs to improve his operating efficiency, or his marketing position, he can usually find it at UOP. Shown here are the more important UOP processes, any one of which can be engineered to fit into any existing or proposed refinery scheme.



PETROLEUM REFINING AND PETROCHEMICAL PROCESSES AVAILABLE FROM UOP

1. CRUDE DISTILLATION equipment is designed and engineered by UOP in any desired capacity.

2. VACUUM DISTILLATION and **VISBREAKING**—easy-to-operate processes for preparation of feed stocks for catalytic cracking.

3. L.P. COKING permits adjustment of gasoline-to-heavy oils production ratio to meet market needs.

4. FLUID CATALYTIC CRACKING—an improved process that gives higher yields, higher octane numbers.

5. UNIFINING™—a modern process that completely purifies petroleum distillates.

6. PLATFORMING® produces high octane gasolines, high purity aromatics.

7. MOLEX™—a new continuous separating process that removes lowest-grade hydrocarbons from gasoline.

8. UDEX®—the ideal process for separation of super-purity aromatics.

9. BUTAMER™—a new and practical process for producing isobutane.

10. PENEX®—a new process that converts light, normal paraffins to isoparaffins.

11. HF ALKYLATION—makes alkylate, top anti-rumble motor fuel. Sulfuric acid process also available.

12. CATALYTIC CONDENSATION—converts olefin fractions of refinery gases into high-quality gasoline and petrochemicals.

13. MEROX™—a new and inexpensive treating process to remove mercaptans from gasolines and light distillates.

PROCESSES NOT ILLUSTRATED:

REXFORMING®—the ideal process to insure your top octane position.

CATALYTIC DEHYDROGENATION—removes hydrogen from hydrocarbons to produce less-saturated hydrocarbons.

HYDEAL™—a new process for the hydrodealkylation of toluene or C_9 aromatics to produce benzene; may also be used for manufacturing phenol and naphthalene.

HYDRAR™—converts benzene to cyclohexane with excellent yields, achieves extreme high purity with Udex grade benzene.

OLEFIN EXTRACTION—efficiently separates olefins and diolefins from paraffins; prepares olefins for further conversion.

AROSORB™—removes heavier aromatics from synthetic and natural distillates, produces aromatic-free heavier distillates.

ALKAR™—produces ethylbenzene, cumene and other alkylated aromatics from Fluid Cat Cracker off-gas streams.

UNISOL®—an economical process for treating high mercaptan-containing gasolines.

*'62 COULD BE
THE YEAR
FOR YOU!

why motorists want higher gasoline quality

Refiners right now have adequate crude capacity, but intermediate and final product processing facilities are still inadequate. Demand for higher quality in gasolines is still growing—and could put refiners in short supply within two years.

Here then, lies opportunity. Manufacturing a larger ratio of higher quality products can raise a refinery operation to new levels of profit.

What will this involve? That depends on existing process facilities, sources of crude supply, actual and potential markets, price levels and other factors.

In all of these areas Universal can provide outstanding service. UOP research and service facilities, know-how, accumulated technical and market data and specialized experience are brought to bear on every facet of the problem—*and there is a UOP process to meet any refinery need.*

Start now to determine the best way to capitalize present and future marketing opportunities.

*THE CONSENSUS OF INFORMED OPINION is that 1962 will require a substantial increase in process capacity . . . NOW is the time to start your planning!

UOP
UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U. S. A.
WHERE RESEARCH TODAY MEANS PROGRESS TOMORROW

PLATFORMING®

One of the most widely used processes in the refining industry, Platforming is the practical and economical method for upgrading gasolines. Originated and developed by UOP, this process is inexpensive to install, reliable and easy to operate. The platinum-containing catalyst is highly active and hence provides truly continuous operation. Costs of periodic shutdowns are considerably reduced and initial cost is lower due to the lack of necessity for expensive regeneration equipment. Platforming can handle the full boiling range gasolines without prefractionation, or naphtha cuts separated from them. It is also highly efficient for producing aromatics such as benzene, toluene and xylenes.

LATIN AMERICAN OIL NEWS

To Manufacture Bits In Mexico

Hughes Tool Co. has made a manufacturing agreement under which rotary bits and tool joints will be made in Mexico for use by the Mexican oil industry by Herramientas de Acero, S.A. de C.V., in Mexico City. The company is building a manufacturing plant at Vera Cruz.

Puerto Rican Failure

The first exploratory test on the island of Puerto Rico was a dry hole at 6,000 ft. The well had been drilled by Kewanee International Oil Co.

Peru's Fertilizer Program

Peru's first chemical fertilizer-producing plant has begun operations in Callao. The new $7 million plant has a capacity of 50,000 tons per year of nitrogenous fertilizers, phosphates, and other products.

Texaco's Trinidad Interests

Texaco's investment in Trinidad has reached $120 million (W.I.) since acquisition of Trinidad Leaseholds. The island's production has doubled in the past three years to 57,000 b/d, according to A. C. Long, Texaco's chairman.

Oil Law Hits Cuba

The Castro government in Cuba has issued Law No. 635 which drastically alters but continues the basic petroleum Law of May 9, 1938. The new law was published in the Official Gazette Nov. 23. It derogates Decree-Law No. 1526 of July 8, 1954 and its extending Agreement-Law No. 40 of July 8, 1958. This legislation had been designed to stimulate exploration; it was considered effective in bringing about the exceptionally high level of exploration activity and expenditures (estimated at $30 million) by private companies in the 1955-1958 period.

The whereas clauses of the new law condemn concession grants by the previous regime and conclude that private enterprise has failed to obtain production or conduct the required exploration work.

Colombia's Oil Bill Stalled

Proposals to change the Petroleum Code in Colombia, opposed by oil companies, are not expected to come in for active consideration in the current session of the Colombian Congress since they are controversial and are not listed as one of the President's legislative musts. The proposals were made by Dr. Alfredo Araujo, Minister of Mines and Petroleum.

The proposals would reduce maximum areas permitted under each concession contract, oblige each contract to relinquish half the contracted area at the end of the exploration period to establish a national petroleum reserve zone, shorten the exploration period, impose drilling obligations, increase surface rentals, increase royalty payments, charge royalties on the basis of the price at the field rather than the port of embarkation.

Oil company officials in Colombia have asserted that if the proposals were adopted it would leave "no attraction to new investors nor encouragement to the companies presently established to intensify their activities." They have added that with world overproduction of oil, the countries where costs are least and physical difficulties least will present the best investment opportunities and that if the proposals are adopted, Colombia would lose out in the world oil market, as the companies would not find it worth their while to explore and develop oil in Colombia.

Buys Interest In Barbados

Mobil International Oil Co. has acquired an interest in the Barbados Union Oil Co., an independent oil refiner and marketer serving the island of Barbados, The West Indies. The Barbados company will expand and modernize its refinery at Bridgetown.

Electronic System

A new electronic supervisory control system, designed and built by Southwestern Industrial Electronics Co., a division of Dresser Industries, Inc., Houston, is being installed for the Phillips Petroleum Co. on a 25-well lease on Lake Maracaibo. The solid state electronic unit provides a push-button control for remote and local well testing and production.

New Ecuadorean Refinery Dedicated

The new refinery of Anglo Ecuadorian Oilfields Ltd. at La Libertad, Ecuador, was dedicated with the assistance of industry and government representatives on Jan. 9. The plant will contribute substantially to the self sufficiency of Ecuador in oil products and has been under construction since January 4, 1956.

Launch For Lake Maracaibo

Cia. Shell de Venezuela has put into Lake Maracaibo service a 70-ft "hydrofoil" launch built by Gusto NV, Schiedam, Holland, capable of carrying 50 persons at 35 knots. Power is supplied by a 1,350 bhp Mercedes-Benz diesel. Three more launches of the same type are being built by Gusto to add to Shell's Lake Maracaibo fleet.

Ecuador's Concession Enlarged

Ecuador has added 44,060 hectares (to a total of 307,060 hectares) to the concession area of California Ecuador Petroleum Co. in Guayaquil province. Contract changes by the government require the company to deposit $50,000 at Banco Central for government mineral studies to deposit $500,000 at the bank within two years of any commercial exploitation to finance public improvements, and to pay $17,624 to the provincial tax collector for surface rights to the concession area.

INTERNATIONAL NEWS & NOTES

(*Continued from page* 12)

Nigeria Well Drilling

Mobil Exploration Nigeria has started drilling a test well near the Atlantic Ocean in the southwest corner of Nigeria—Afowo 1 will be the first well on Mobil's 100%, 2.5 million acre concession in west Nigeria.

Jordan Ups Aqaba Traffic

New facilities under the seven-year program with UN assistance have increased traffic at port of Aqaba 12-fold—to 600,000 tons annually of cargo handled in 1959 from 50,000 tons. A small petroleum terminal, with a 16,000-ton tank farm, is part of the basic layout provided by UN aid.

Esso To Start Libyan Testing

Esso Sirte Inc. will start early wildcats on Blocks 17 and 20 in Cyrenaica and Tripolitania provinces in Libya on its half-interest acreage recently acquired from Libyan American Oil Co. (Texas Gulf Producing-subsidiary) and W. R. Grace & Co. Tests are proceeding on a third wildcat which had been plugged back to 3,800 ft from 8,060 ft.

Forms Turkish Refining Company

A new company to own and operate the proposed $25,650,000, 20,800 b/d Istanbul Refinery is being formed by California Texas Oil Corp. and Turkiye Petroleri A.O. (TPAO), Turkish Government owned company. Name of the firm will be Istanbul Petrol Rafinerisi A.S. (IPRAS).

Dr. Sahap Birgi, president of TPAO, together with some members of his management staff have been in New York reviewing all details of this project. The main construction contract has been awarded to M. W. Kellogg Co. The refinery, at the deep water port of Izmit, will have a crude distillation unit, naphtha Unifiner, Platformer, distillate hydrotreater and fluid catalytic cracker.

Geo Enters Australia

Austral Geo Prospectors Inc., a U. S. subsidiary of Geo Prospectors, of Tulsa, will take an interest in three Australian oil prospecting companies, Associated Australian Oilfields, N.L.; Australian Freney Oilfields, N.L., and Papuan Apinaipi Petroleum Ltd.

Iran Wildcat Hits

The oil consortium at Iran reports that its wildcat well at Binak has been completed at 10,822 feet in 99 feet of cretaceous limestone from the 10,723 foot level. After acidizing, two tests were run from the 8,454 and 8,474 foot levels, through a two-stage test unit. Production rates were from 1,800 to 3,340 b/d with a separator pressure of 200-210 psi and a separator gas-oil ratio of 581-378 cu ft/bbl. Flowing wellhead pressure was 500 psi at 2,600 b/d and shut-in wellhead pressure was 2,200 psi. Static bottom hole pressure was 5,720 psi at 10, 710 ft. Gravity of the flow tank oil was 31° API.

Red China's Oil Up

Crude oil output is 55% higher than last year so far, according to the Peking Minister of Petroleum. UPI quoted him as saying output will top 3.5 million tons (70,000 b/d). Yu Chiu-Li said 32 new gas and oil fields have been discovered since the beginning of '58 bringing the nation's total to 50.

Australia Consumes More Oil

Australia consumed nearly three times as much oil in the 12 months to June 30, 1959 as it did in 1948-49. The nation's total consumption of petroleum products in 1958-59 was 2,588 million gallons of which motor gasoline accounted for nearly 1,100 million gallons. This is compared with a total consumption of 945 million gallons in 1948-49. Oil now supplies 37% of the commercial energy as against only 23.5% 10 years ago.

Australian Test Planned

Australian Oil Corp., Ltd., and its U. S. partners will drill towards the end of 1960 in the Surat Basin (formerly known as Thallon Basin) in southwestern Queensland and northern N.S.W. The U. S. partners are Union Oil Co. of California, and Kern County Land Co.

Soviets Helium From Gas

Soviet scientists have developed a method of obtaining helium from wet gas by subjecting it to a pressure of 568.92 psi at 95°. This process is said to require only half of the electric energy necessary for the conventional method. The costs for such plants are likewise cheaper by 50%.

USSR Discoveries

Thirteen oil and gas fields have reportedly been discovered in Bashkiria during 1959. A new gas field in the south is estimated at 8 trillion cu ft. At Kyanisadag, 30 miles south of Baku, on the Caspian Sea, a new oil field has been put on production. The field is believed to extend 18 miles into the sea.

Alberta Approves Gas Export

The Alberta government has approved four applications for permission to remove additional volumes of gas from the province. The National Energy Board is now considering the applications for export from Canada to the USA.

The provincial action was taken in January on recommendations of the Alberta Oil and Gas Conservation Board concerning applications of Trans-Canada Pipè Lines Ltd., Alberta and Southern Gas Co. Ltd., Westcoast Transmission Co. Ltd., and the Saskatchewan Power Corp.

Amounts requested in each case were over and above the amounts already held under permits received in Alberta. Combined amounts of additional volumes total 2.935 trillion cubic feet in the case of the export companies, this breaking down as follows: Trans-Canada—735 billion cf; Alberta and Southern, 1.9 trillion; and Westcoast, 300 billion. Saskatchewan Power was authorized to increase from 223 billion to 617 billion of the amount of gas held under permit. Total additional volumes come to approximately 3.3 trillion cf.

The Conservation Board report dealing with these applications showed established reserves have climbed to 27.7 trillion cf, up 2.1 trillion since the Board's last such analysis in March, 1959.

Canada's Drilling Down In 1959

Final count of 2,515 wells drilled in western Canada in 1959 is down about 3% from 1958 completions. Forecast is for 2,500 wells each in 1960 and 1961.

...the past will brighten his future

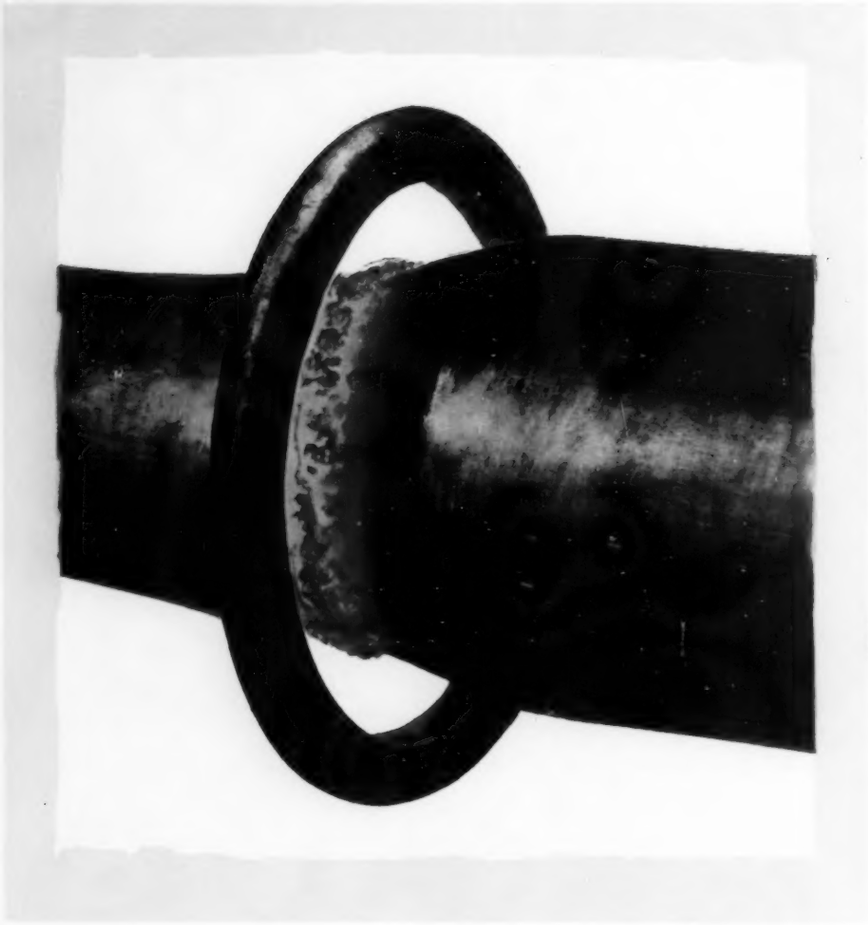
This boy will live a better life than his parents have known. Oil will power the machines that will help make this a reality.

To make this possible, the search for oil must never stop. Formed in pre-historic times, crude oil is found deep in the earth's crust. Locating it demands all the skills modern science can command. And Standard-Vacuum is ready—with the personnel, the equipment and the experience needed to carry on this vital work.

But exploration is only one part of Stanvac operations. Throughout Asia, Africa and the lands of the Pacific, Stanvac drills for oil, then refines and markets it in many forms. In this way, Stanvac helps the people in these areas to help themselves toward a better life.

STANDARD-VACUUM [illegible] **POWERS PROGRESS**

White Plains, New York



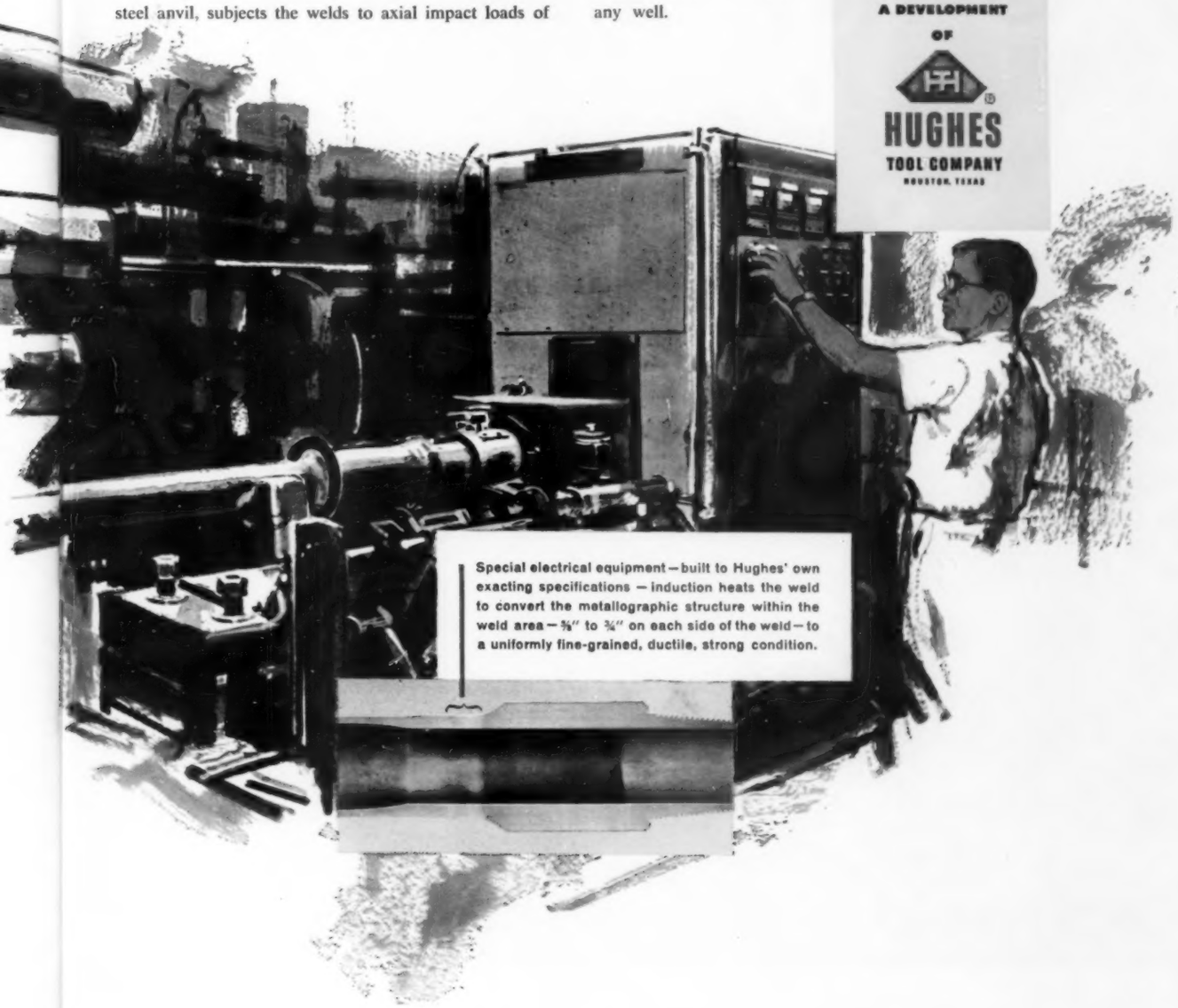
Magic Ring induction heat-treating more than doubles the impact strength of HUGHES "Flash-Weld" tool joint-to-pipe connections

Electronically-controlled inductor rings are used in the new Hughes heat-treating process to normalize and stress-relieve the weld area of "Flash-Weld" tool joint-to-pipe connections. This results in connections with metallographic uniformity across the weld never before available to the industry.

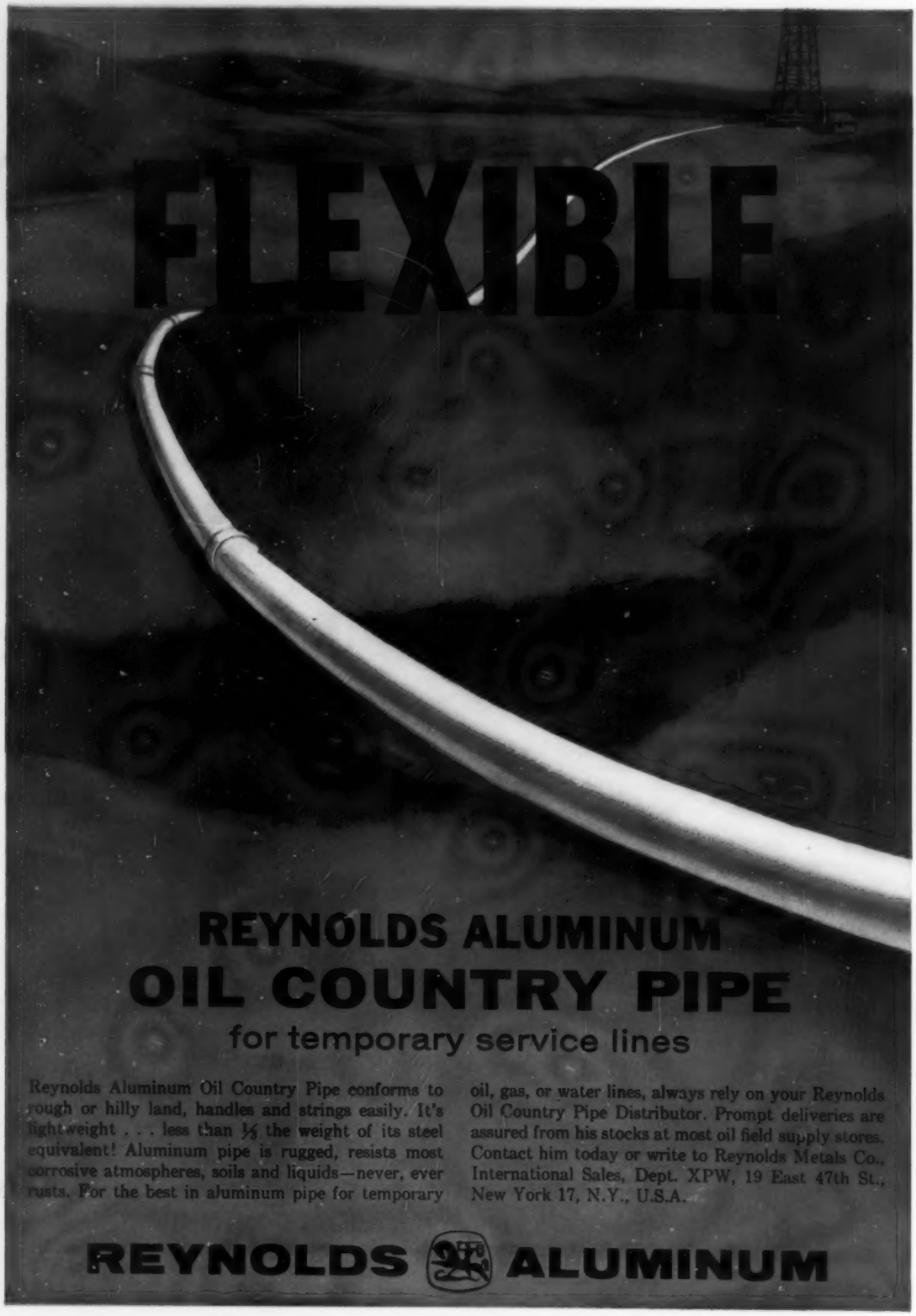
To fully evaluate the metallurgical properties obtained in the weld area by the new process, Hughes engineers developed the world's largest tension-impact testing equipment. A heavily weighted drillstem, dropped in a well and caught at the tool joint box shoulder in a steel anvil, subjects the welds to axial impact loads of more than 400,000 foot pounds. In more than 200 of these destruction drop tests—the severest to which welds have ever been subjected—not a single weld, heat-treated with the Hughes *Magic Ring*, was broken.

These important additions to the Hughes flash-welding process, plus other engineering and design features developed in unitizing more than 40 million feet of drill pipe since 1938, assure you the *most dependable* and *most economical* drillstem you can run in any well.

FLASH-WELD
A DEVELOPMENT
OF
HUGHES
TOOL COMPANY
HOUSTON, TEXAS



Special electrical equipment—built to Hughes' own exacting specifications—induction heats the weld to convert the metallographic structure within the weld area—⅛" to ¾" on each side of the weld—to a uniformly fine-grained, ductile, strong condition.


FLEXIBLE
REYNOLDS ALUMINUM
OIL COUNTRY PIPE
for temporary service lines
Reynolds Aluminum Oil Country Pipe conforms to rough or hilly land, handles and strings easily. It's lightweight . . . less than 1/3 the weight of its steel equivalent! Aluminum pipe is rugged, resists most corrosive atmospheres, soils and liquids—never, ever rusts. For the best in aluminum pipe for temporary oil, gas, or water lines, always rely on your Reynolds Oil Country Pipe Distributor. Prompt deliveries are assured from his stocks at most oil field supply stores. Contact him today or write to Reynolds Metals Co., International Sales, Dept. XPW, 19 East 47th St., New York 17, N.Y., U.S.A.
REYNOLDS ALUMINUM

CALTEX

Caltex...serving every petroleum need in 77 countries in Europe, Africa, Asia and Australasia

Wherever air drilling solves the problem . . . Gardner-Denver has the answer

- Air drilling
- Aerated mud
- Muddiated air
- Mist drilling
- Gas drilling
- Restoring lost circulation

THERE'S NO SUBSTITUTE FOR MEN

100 years of customer confidence. Side by side with "roughnecks," the Gardner-Denver man finds himself out on lonely offshore barges or in oil fields scattered throughout the world—always keeping a careful eye on his equipment's performance.

A background of experience in developing compressors and devising techniques for every phase of air drilling provides Gardner-Denver specialists with a fund of knowledge that's at your service wherever compressed air may solve a drilling problem for you.

Alaska, Canada, United States, Mexico, Australia . . . Guatemala, Honduras, the Bahamas . . . Turkey, Libya, Algeria, Saudi Arabia. Wherever air drilling has been put to work, Gardner-Denver specialists have worked side by side with drilling crews.

In scorching desert temperatures of 135° . . . at 55° below in the Arctic . . . at sea level . . . or at altitudes of 10,000 feet, Gardner-Denver equipment has passed the toughest test of all—field experience.

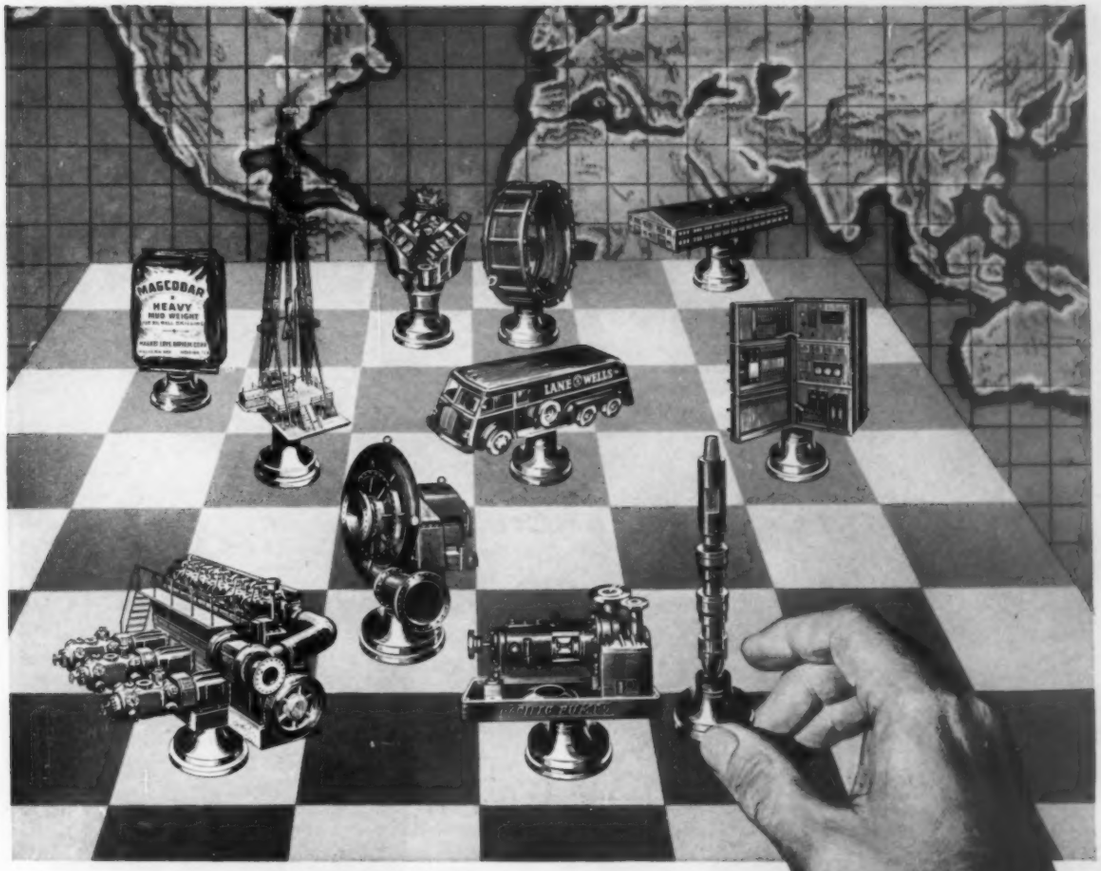
Specify Gardner-Denver compressors with confidence for air drilling any size hole to any depth, with seismograph rigs or with the largest of land-based or offshore rigs.

Consult your Gardner-Denver air drilling specialist—or write for further information.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario
Gardner-Denver Export Division, 233 Broadway, New York 7, N. Y.
Petroleum Offices: Casper, Cleveland, Columbus, Corpus Christi, Dallas, Denver, Durango, Edmonton, Ellinwood, Evansville, Houston, Huntington, Jackson, Kansas City, Lafayette, Los Angeles, Mexico City, New Orleans, Odessa, Oklahoma City, Pittsburgh, San Francisco, Shreveport, St. Louis, Tulsa, Wichita, Winnipeg



'Round the world, make your next move to Dresser!

Petroleum, priceless ingredient of energy as well as boundless by-products, plays a universal game of hide and seek with the world's oil men. Wherever the ground justifies the gamble, Dresser representatives are on hand to provide specialized equipment and technical services that encourage success. These men of Dresser are identified by many corporate names . . . for Dresser Industries, Inc. is a group of specialized companies each of which operates independently to better serve your needs. Though representing any one of the operating units, Dresser men are prepared to put at your service the famed Dresser *plus* +. This *extra* value results from the coordinated performance of all Dresser companies—combining global experience, engineering talent and diversified manufacturing facilities in many countries. Throughout the oil, gas, chemical and electronic industries the Dresser *plus* + is your assurance of superior equipment and technical services—the standard of comparison the world over.

Tomorrow's progress planned today by men with imagination

DRESSER INDUSTRIES, INC.

EQUIPMENT & TECHNICAL SERVICES
OIL • GAS • CHEMICAL • ELECTRONIC • INDUSTRIAL
REPUBLIC NATIONAL BANK BLDG.
DALLAS, TEXAS, U.S.A.

General Representative in the Eastern Hemisphere:

DRESSER A. G.
Mühlebachstrasse 43, Zürich, Switzerland

IN ENGLAND: **Dresser (Great Britain) Ltd.,** *197 Knightsbridge, London, S.W. 7*

IN FRANCE: **Dresser (France) S.A.** *37, Ave. D'Iena, Paris 16*

IN ITALY: **Dresser Italy S.p.A.,** *Piazza Cavour, 2, Milan*

ADVANCED ENGINEERING

CONSTANT RESEARCH

MODERN MACHINING

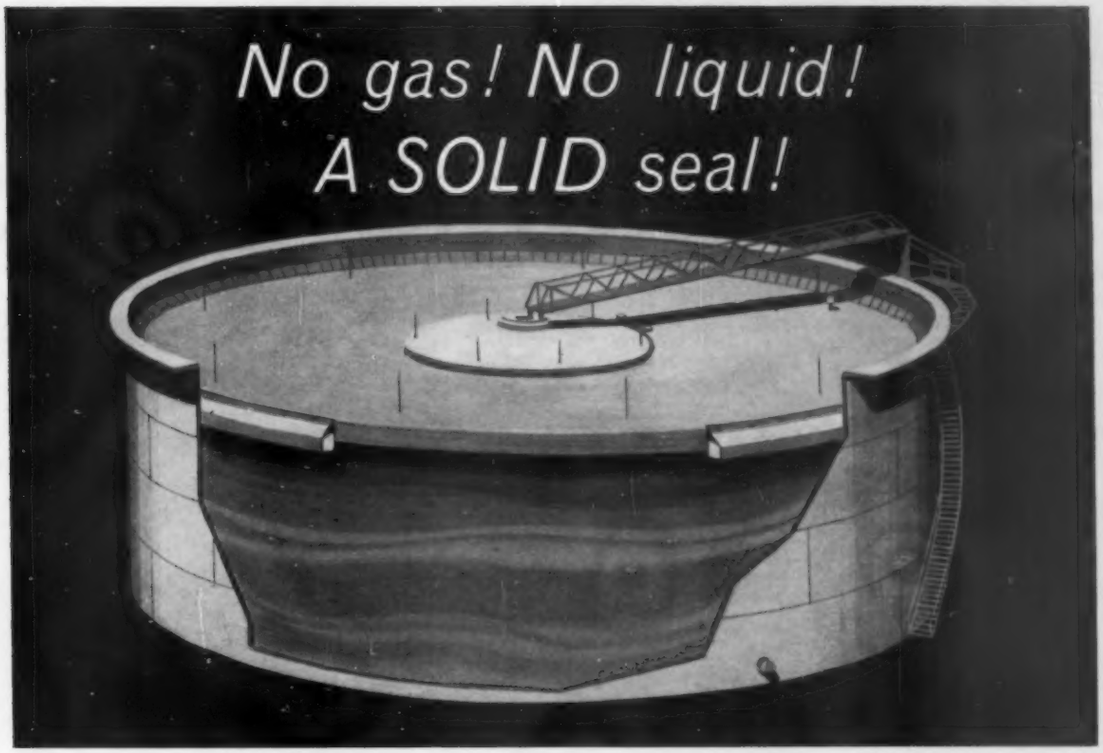
WORLD-WIDE DISTRIBUTION

Smith TOOL CO.

(FORMERLY H.C. Smith OIL TOOL CO.)

Branches in Principal Oil Centers
Throughout the World

COMPTON, CALIF. • OKLAHOMA CITY
ODESSA • HOUSTON • DALLAS
GREAT BEND • EDMONTON



nothing can disable

EverSeal*

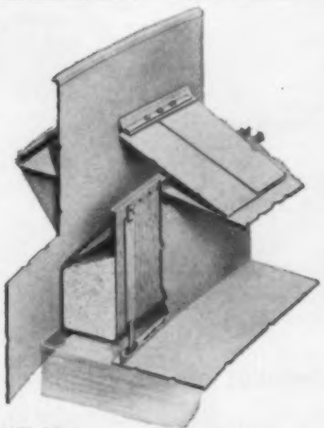
General American's new cushion seal for floating roofs

Tear it! Gouge it! Puncture it! The seal will hold. No matter what the damage, it will not burst or rupture! There's nothing in EVERSEAL to spill or leak.

Urethane cushions firmly joined and enclosed in a vapor-tight, no-scuff envelope of BUNA "N" and PVC are protected by the General American weather hood.

EVERSEAL resists the abrasive action of rough tank walls, yet will not scratch or damage tank coatings.

Get the complete details about EVERSEAL! Write the General American office nearest you. For any type of conservation structure, *it pays to plan with General American.*



WHY THE NEW GENERAL AMERICAN EVERSEAL IS FAR BETTER THAN ANY TUBE TYPE SEAL

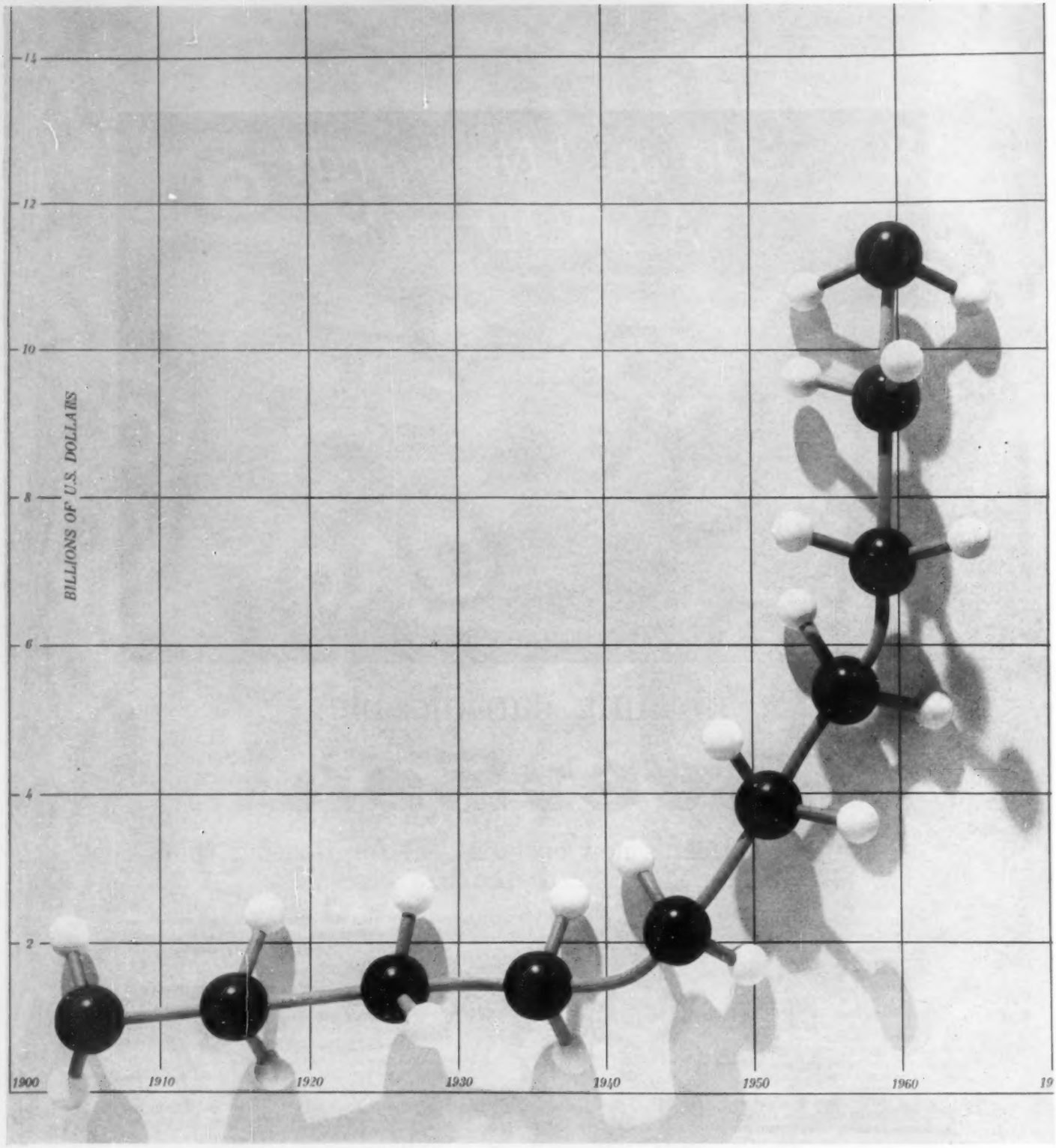
1. No liquid or gas to leak
2. Replace entire seal or a section without taking roof out of service
3. EVERSEAL will accommodate a 10" variation in annular space between roof and shell
4. No moving parts—nothing to corrode
5. Costs less than most other seals
6. Permits full travel of roof, yet rides easily over projections on shell and maintains seal
7. Protected from sun, rain, snow and dirt by the General American weather hood
8. Eliminates buildup of vapors in seal area
9. Will not freeze to sides of tank
10. Provides full protection for oxygen-sensitive stocks

*Patents Pending

Plate & Welding Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street, Chicago 3, Illinois • Offices in Principal Cities



"The upcurve in technology seems to be accelerating. In 1900, industrial research and development was practically non-existent. In 1928, the nation spent less than $100 million for these purposes. Today, expenditures for research and development exceed $10 billion . . . just about double the amount spent only six years ago." —M. J. Rathbone, President

ESSO

Standard Oil Company (New Jersey)

*'62 could be the year for you!

YOU WIN BEFORE YOU START...

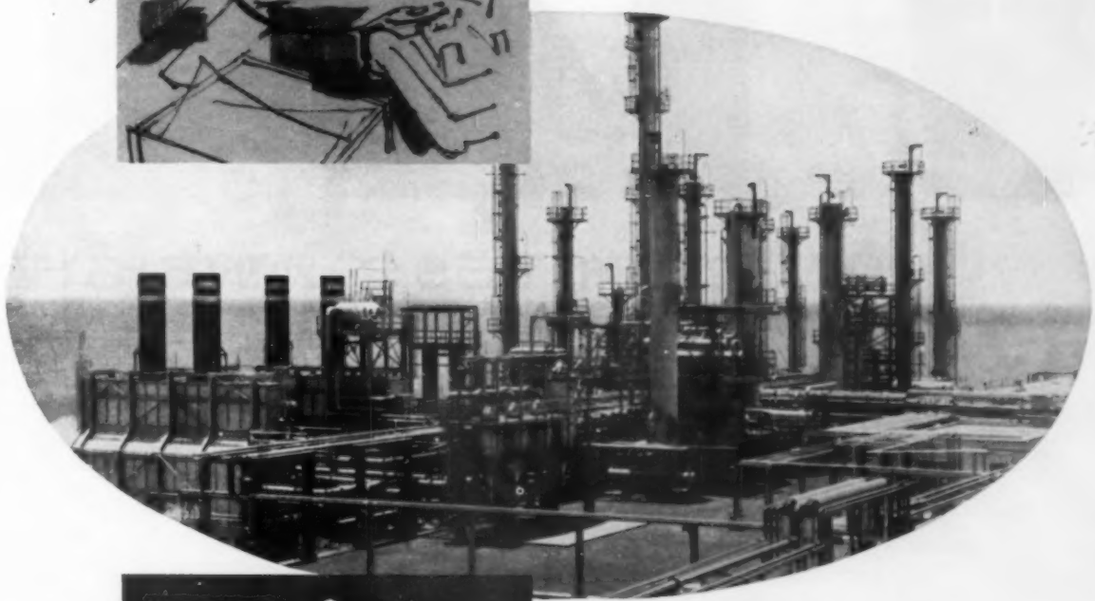
It's a long road from blueprint and flow chart to efficient plant performance. It takes an intimate knowledge of the route to assure safe and timely arrival.

To show where you're headed before you start, Procon presents an accurate picture of what will be provided for every penny invested.

Regardless of where or what the client plans to build . . . petroleum, petrochemical or chemical process facilities . . . Procon prepares a firm proposal covering every detail of construction.

Before planning new construction, consult Procon. It pays . . . in superior construction and assured plant performance.

*A SUBSTANTIAL INCREASE IN PROCESS CAPACITY will be needed by 1962, according to reliable estimates . . . NOW is the time to start your planning!



PROCON®

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM PETROCHEMICAL AND CHEMICAL INDUSTRIES

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U.S.A.

PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA
PROCON (GREAT BRITAIN) LIMITED, LONDON, W. C. 2, ENGLAND
PROCON PTY. LIMITED, SYDNEY, AUSTRALIA
PROCON INTERNATIONAL S. A.
VICAPROCON, S. A., CARACAS, VENEZUELA

CUMM

V-12 D

COST LESS...WEIGH LESS.E

VT-12 SPECIFICATIONS

Max. h.p.	600 to 2100 r.p.m.
No. of cylinders	12
Bore and Stroke	5⅛" x 6"
Displacement	1486 cu. in.
Compression ratio	13.5 to 1

CUMMINS DIESEL INTERNATIONAL LTD.

(A wholly-owned subsidiary of Cummins Engine Company, Inc. Columbus, Indiana, U. S. A.)

Main Office: NASSAU, BAHAMAS—Cables: CUMNAS

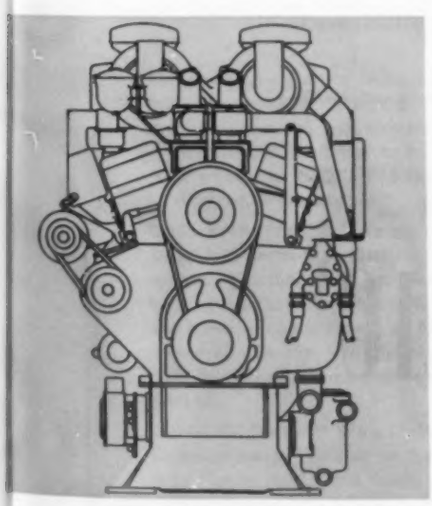
European Office: ZURICH, SWITZERLAND—Cables: CUMZURI

Affiliate: Motores Cummins Diesel do Brasil Ltda. Sao Paulo, Brazil—Cables: CUMBRAS

Affiliate: Cummins Engine Company, Ltd. Shotts, Lanarkshire, Scotland—Cables: CUMSCOT

MINS
ESELS

S.EARN MORE PROFIT FOR OIL MEN!

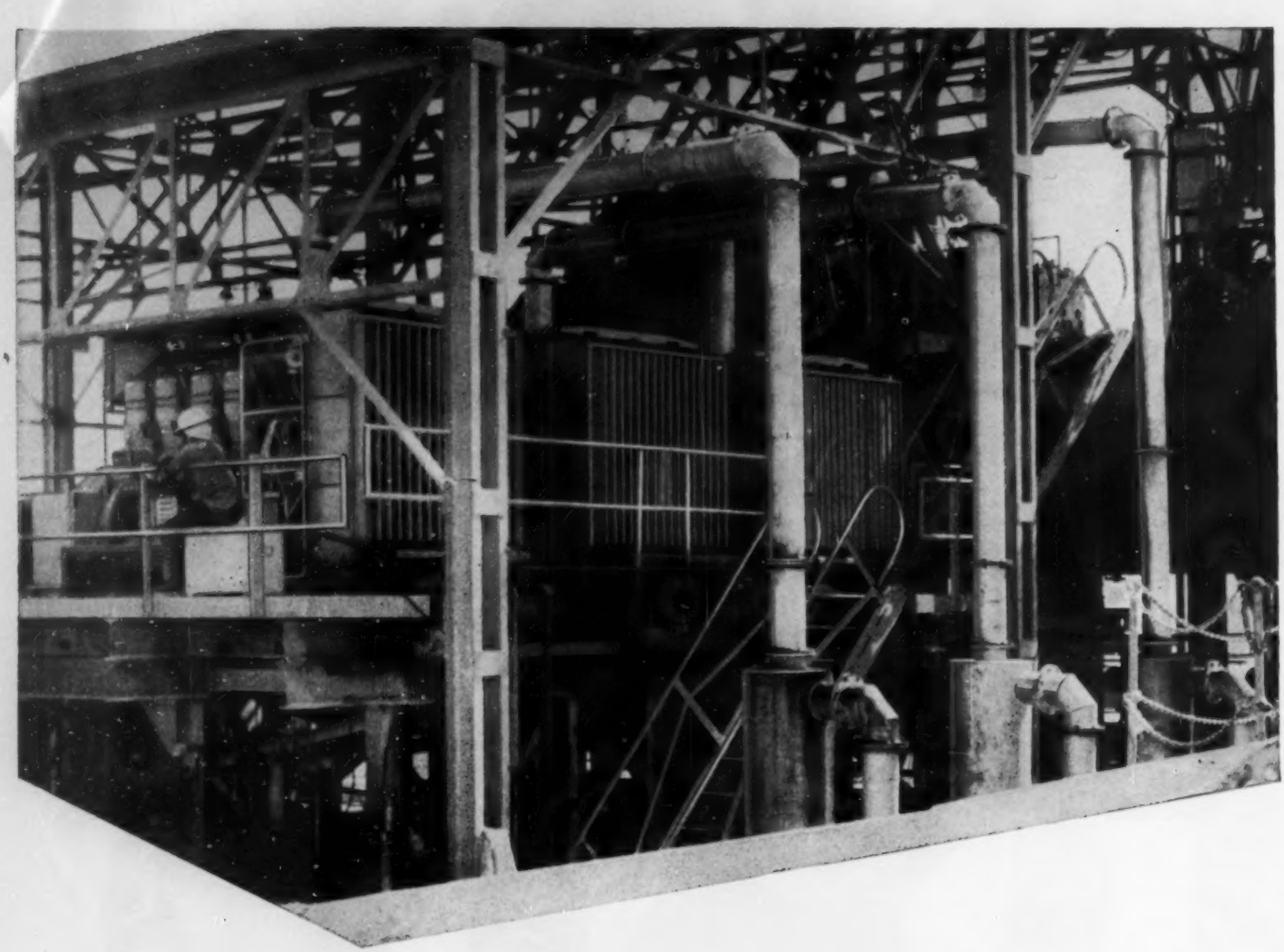


You can purchase a Cummins V-12 power unit for ⅓ the cost of comparably rated medium speed (1100-1300 rpm) diesel engines for either torque converter or electric drilling rigs. You also get the quality and features that have made Cummins world famous.

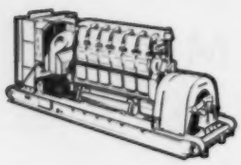
Cummins V-12 Diesel drilling units weigh approximately 40% less per h.p. delivered than medium speed engines of comparable rated h.p. This means a high degree of portability permitting extra savings in lighter equipment—faster move and rig-up time. Choose from two models—the 450 h.p. NVH-12 or the 600 h.p. VT-12. Either model delivers the low-cost dependable performance that means more profit!

Cummins Engines and parts manufactured in the U.K. and U.S.A. are available from more than 190 overseas sales and service points.

CUMMINS



Deep drilling at Qatar



The largest drilling rig in the Middle East has been commissioned by the Iraq Petroleum Company in the Dukhan Field, Qatar, where it is intended to penetrate to 18,000 feet. This rig is powered by three 'ENGLISH ELECTRIC' 8VD diesel package sets and can attain much greater depths.

Each package set is of 525 b.h.p. continuous site rating at 775 r.p.m., with a maximum output of 605 b.h.p. at 850 r.p.m. for intermittent heavy duty.

Power can also be taken from these units for a slush pump drive, whilst two additional 8VD units drive an independent slush pump. All five units operate as either diesel or dual-fuel engines.

'ENGLISH ELECTRIC'

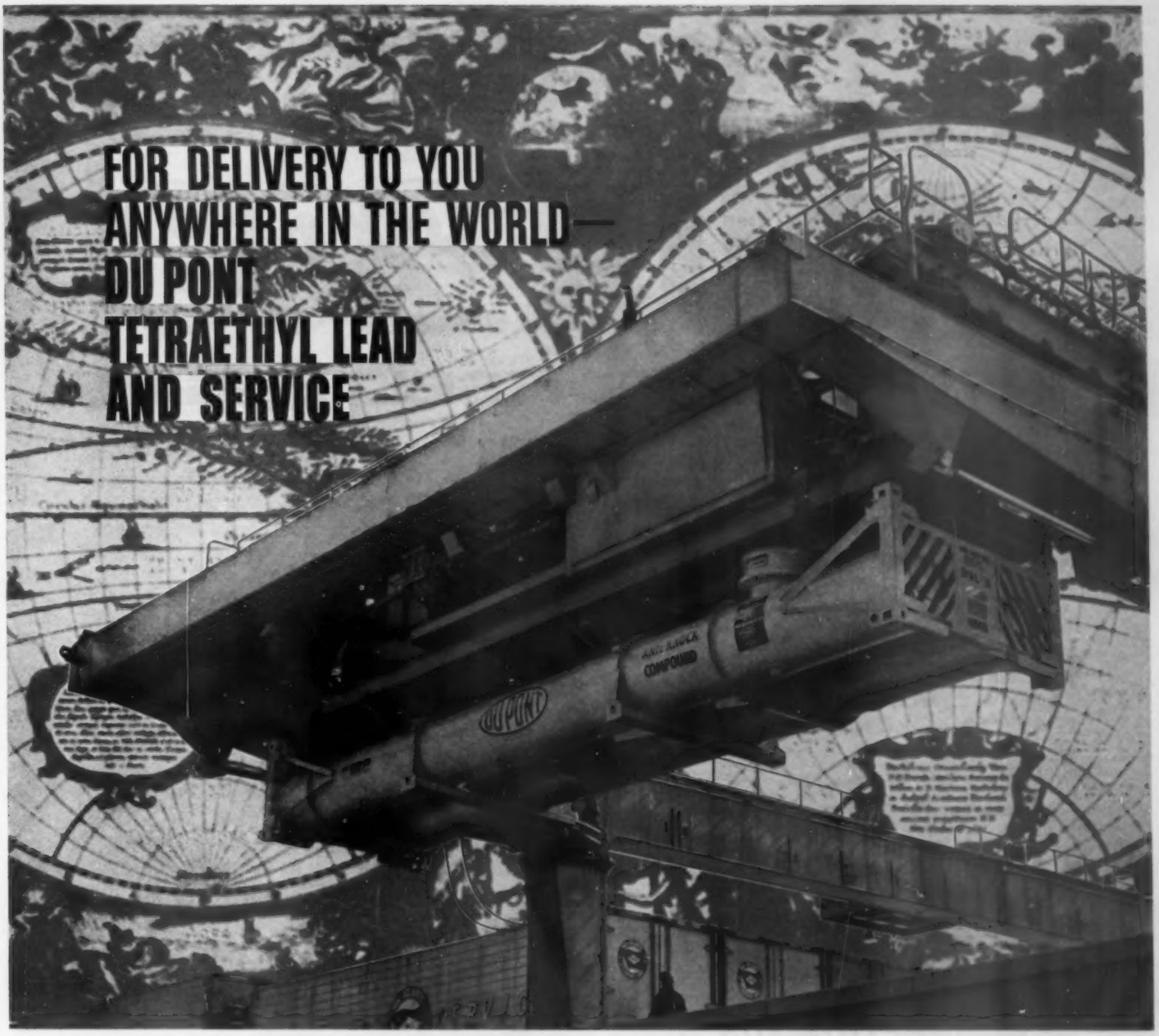
diesel and dual-fuel engines

148 b.h.p. to 2504 b.h.p.

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

Offices and representatives throughout the world

DE.93



Du Pont TEL made in the U. S. is shipped to certain overseas ports in special 34,000-lb. containers.

The containers you see being loaded aboard ship are specially designed for shipping Du Pont tetraethyl lead overseas.

These are on their way to Puerto Rico. In ports where the 34,000-lb. containers cannot be received, drums are used.

GOES EVERYWHERE: Such attention to your individual needs is the hallmark of Du Pont supply. Whether your refining facility be high in the Peruvian Andes, far up the Amazon River, along the coast of Japan—*or anywhere else in the free world*—you can get TEL in the quantities you need, when you need it.

COMPLETE SERVICE: With Du Pont TEL goes technical service similar to that enjoyed by refineries in the United States.

You can get expert help in designing, testing and starting up TEL blending equipment. Du Pont also will train your personnel, keep them up to date on such developments as dry dye eduction, the Du Pont siphon starter, and blending plant safety procedures.

SAFETY AND SALES PROGRAMS: Naturally the Du Pont representative serving your part of the world is available to advise and consult on prompt, safe delivery and handling of TEL.

Routine servicing also includes supplying technical literature, films, and sales promotional materials.

OTHER ADDITIVES: Your other petroleum additive needs can also be met anywhere in the world by Du Pont.

We shall be happy to provide details on the full line of Du Pont dyes, as well as additives for combating copper-caused gum, providing stall protection, preventing sludge formation, protecting against oxidation, and coating copper parts to prevent the metal going into the product.

Get all the facts you need to meet your TEL and other petroleum additive needs by writing to: Petroleum Chemicals Division, Export, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

DU PONT

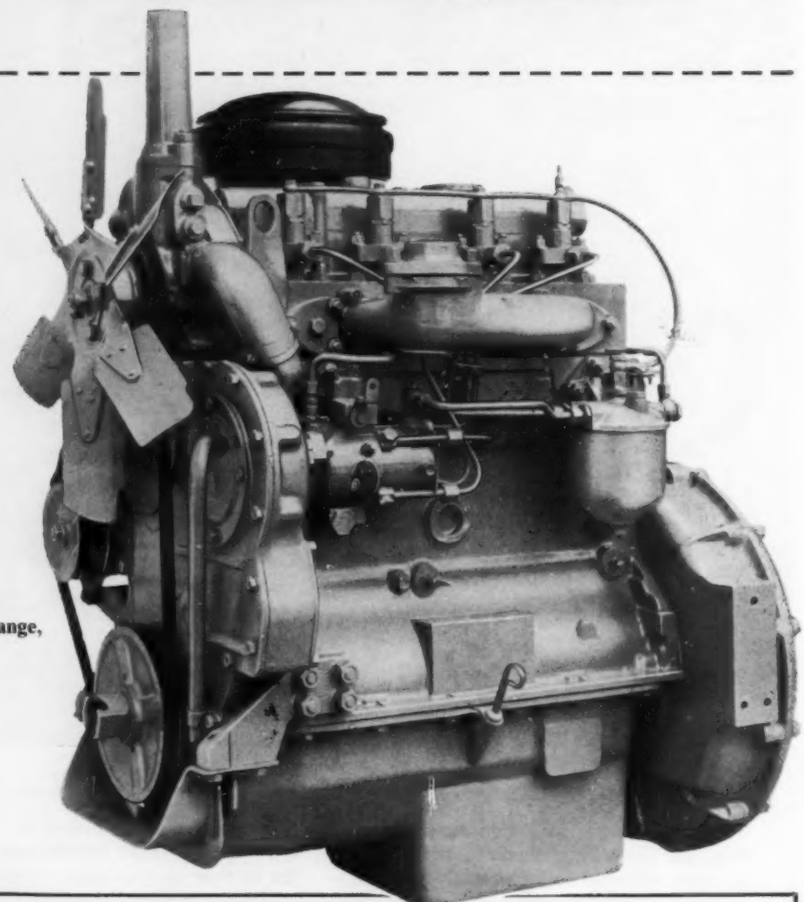
Better Things for Better Living
. . . through Chemistry

Tetraethyl Lead
and other
Petroleum Additives

THE NEW Perkins FOUR 203

INDUSTRIAL DIESEL ENGINE

RATING UP TO 60 b.h.p. AT 2400 R.P.M.



*** A NEW DIESEL ENGINE**
based on 27 years design and manufacture experience.

*** CHROME LINERS**
— means longer engine life.

*** DISTRIBUTOR TYPE FUEL PUMP** — ensuring smooth running high degree of flexibility throughout speed range, and elimination of surge.
Exceptional POWER to weight ratio.

BRIEF SPECIFICATION **FOUR 203**

NO. OF CYLINDERS 4
BORE . . . . . 3.6″
STROKE . . . . . 5″
SWEPT VOLUME . . . . . 203 cu. ins

The Perkins Four 192 industrial diesel engine is also available at 58 b.h.p. at 2400 r.p.m. (Intermittent).

R.P.M./GROSS B.H.P.						
	1000	1200	1500	1800	2000	2400
12 HOUR RATING	25	30	38	44	47	—
1 HOUR RATING	27.5	33	41	48	52	—
INTERMITTENT RATING	28	34	43	50	54	60

Perkins HIGH QUALITY DIESELS

... FOR INDUSTRIAL, VEHICLE, AGRICULTURAL & MARINE APPLICATIONS

PERKINS ENGINES LTD · PETERBOROUGH · ENGLAND

A superior thru-tubing jet perforator featuring:

ENCLOSED FIRING SYSTEM

MINIMUM DEBRIS

DEEP, CARROT-FREE PENETRATION

HIGH WELL FLOW INDEX

ALL NEW McCULLOUGH *mac-jet*

The McCullough Mac-Jet is an all-new development in expendable jet perforating – designed to provide maximum perforating efficiency – to obtain highest production from thru-tubing and slim hole completions.

- Enclosed Firing System – Each Mac-Jet unit is self-contained, including jet charge and integrated firing system, enclosed in a frangible, high strength case. This design eliminates the use of exposed primacord. Units are securely locked together and may be fired from bottom up or from top down.
- Minimum Debris – Entire Mac-Jet Perforator breaks up into small bits when fired. Mac-Jet units, spacers and bottom firing assembly are all disintegrating to assure complete break-up.
- Superior Perforation Characteristics – "big gun" performance – penetration equal to or better than that of many larger jet casing guns. Carrot-free perforations, large deep holes, high well flow index.
- Size, Shot Density, Length – 1 11/16" OD and 2 1/16" OD Standard shot density is four per foot, 90° phasing.

Disintegrating spacers are supplied to provide fewer shots per foot when required. Any number of Mac-Jet units may be run in any length desired.

SPECIFICATIONS:

	1 11/16" OD	2 1/16" OD
Pressure, Temperature Rating	15,000 psi. @ 300°	13,500 psi. @ 300°
Maximum Temperature	350°	350°
Total Charge Weight	12 grams	20 grams
Av. Penetration (Berea Sandstone)	5.69"	7.45"
Av. Entrance Hole	13/32"	3/16"
Av. Well Flow Index	1.1+	1.44
Fill-up – 1' Gun, 5½" Casing	1"	–
Fill-up – 1' Gun, 7" Casing	½"	1"

Standard Berea Sandstone target perforated by 1 11/16" OD Mac-Jet. Average penetration, 5.69"; average entrance hole size, 13/32; average well flow index, 1.1+

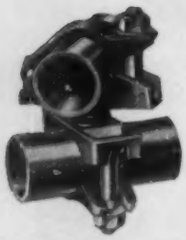
DISINTEGRATING SPACER – Available in various lengths to provide fewer than four shots per foot. Disintegrates into small bits when perforator is fired.

McCullough *TOOL COMPANY*

LOS ANGELES • HOUSTON • EDMONTON • *CABLE ADDRESS: MACTOOL*

LONDON & MIDLAND STEEL SCAFFOLDING CO. LTD.

BURTON'S PATENT DOUBLE-GRIP SCAFFOLDING FITTINGS



BURTON'S PATENT SWIVEL COUPLER
For Coupling Bracing Tubes to Strengthen Scaffold.

BURTON'S PATENT SPLIT JOIN PIN
For Securing Two Tubes Firmly Together, End to End.

BURTON'S PATENT PUTLOG COUPLER
For fixing Putlogs or Transoms to Horizontal Tubes.

BURTON'S PATENT DOUBLE COUPLER
For Coupling Upright Tubes to Horizontal Tubes.

SOLID STEEL DROP-FORGED SCAFFOLDING FITTINGS
MANUFACTURED TO B.S.S. 1139-1951
SPECIFIED BY LEADING ENGINEERS AND CONTRACTORS

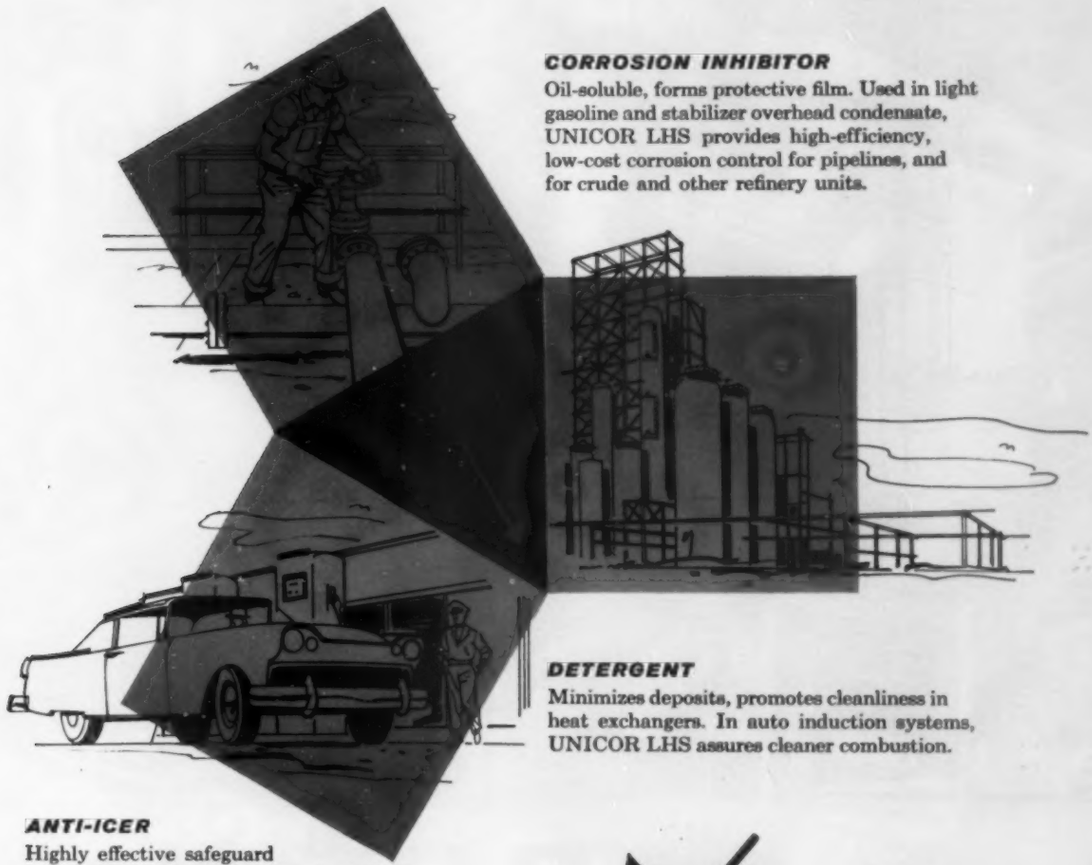
FOR SPEED & STRENGTH IN GENERAL CONSTRUCTION

WORKS. ST. LUKE'S WORKS, OLD HILL, STAFFORDSHIRE, ENGLAND
TELEPHONE: CRADLEY HEATH 69181—5 LINES. PBX. **TELEGRAMS:** DUBELGRIP, CRADLEY HEATH
LONDON OFFICE: 6, LYGON PLACE, LONDON S. W. 1
TELEPHONE: SLOANE 7291-3 **TELEGRAMS:** DUBELGRIP, SOWEST, LONDON

New... ...triple-purpose anti-icer

UNICOR LHS®

provides valuable refinery and pipeline service, too!



CORROSION INHIBITOR

Oil-soluble, forms protective film. Used in light gasoline and stabilizer overhead condensate, UNICOR LHS provides high-efficiency, low-cost corrosion control for pipelines, and for crude and other refinery units.

DETERGENT

Minimizes deposits, promotes cleanliness in heat exchangers. In auto induction systems, UNICOR LHS assures cleaner combustion.

ANTI-ICER

Highly effective safeguard against carburetor icing, prevents stalling. UNICOR LHS is convenient and economical to use, and is instantly miscible in lightest components of winter-grade gasolines.

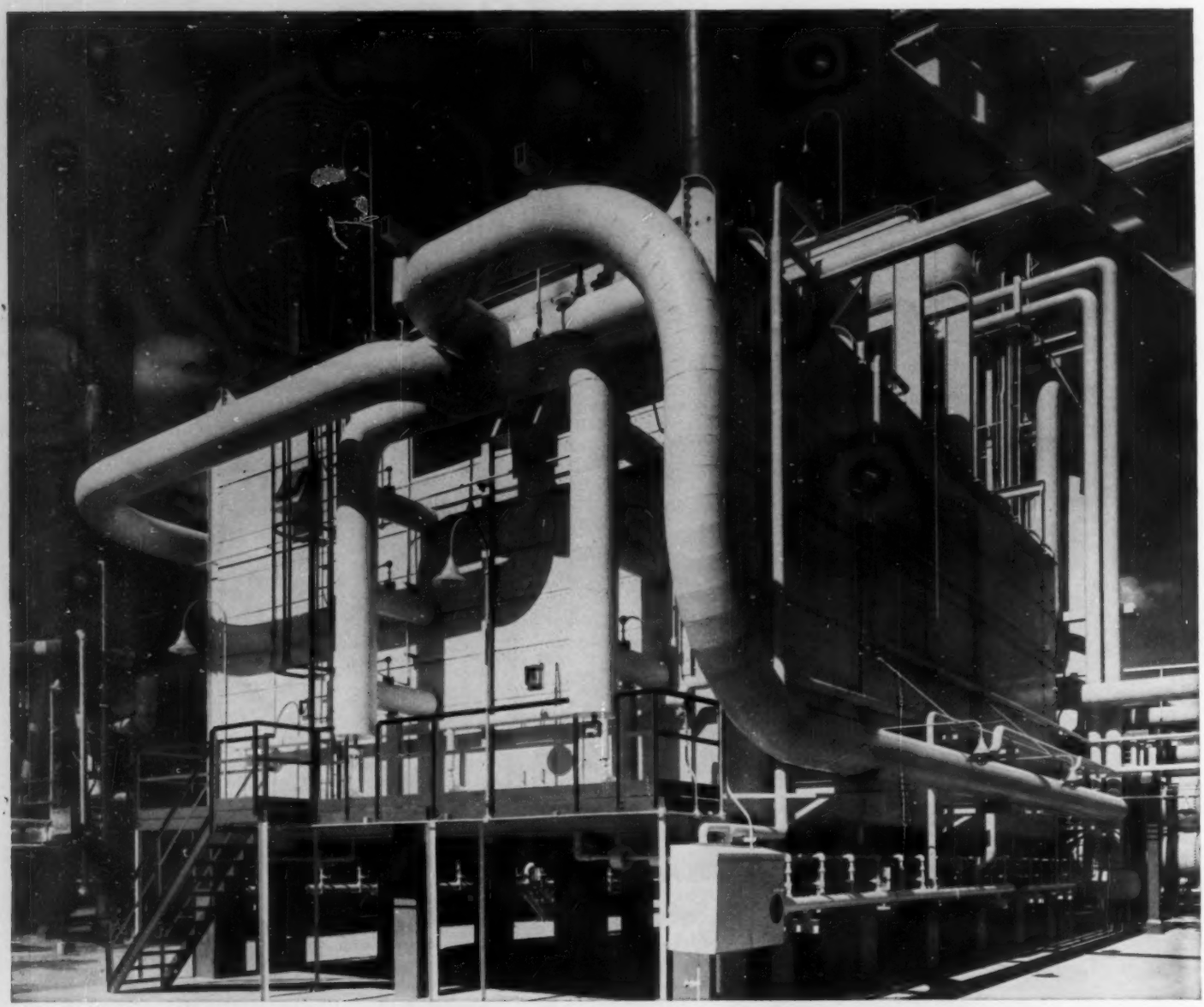
Get the facts today! Write or phone for information and samples. Address our Products Department.

UOP®

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U.S.A.

Lower Costs + Higher Efficiencies



that's what makes **BORN** *heaters*

BORN Heaters mean lower construction, operating and maintenance costs with higher efficiencies and greater safety. Developing over 85% heating efficiency, without costly blowers, fans and other mechanical equipment, these heaters range from 500,000 to more than 200,000,000 BTU per hour absorption duty. Special Born features include the airtight plenum chamber, safeguarding against external explosions, suspended tube arrangement, even heat distribution, removeable wall panels, etc. Find out all about Born Heaters and how they can work more efficiently for you. Your enquiry to the address below will bring full details and technical data.

THE

WORLD'S

FINEST

AYLING INDUSTRIES GROUP

H & E LINTOTT LTD · HORSHAM · SUSSEX · ENGLAND

Telephone: Horsham 3316 · Telex: 8746 · London Office: Grand Buildings, Trafalgar Sq., W.C.2 · Telephone: Trafalgar 8282

ITALIAN OFFICE: Recapito di Milano: Via Benigno Crespi, 70 Tel. 603870

Report from Rogers

The true value of the final, the complete geophysical report stems from many mechanics, many techniques, many interpretations that follow the first survey. The final Rogers Geophysical Report is an *expert* and thus *complete* analysis of the known and unknown of your potential oil province. That is because the expertness of Rogers extends to all the vital links between the Report and the first planning. Completeness and expertness are Rogers' bywords in geophysical prospecting.

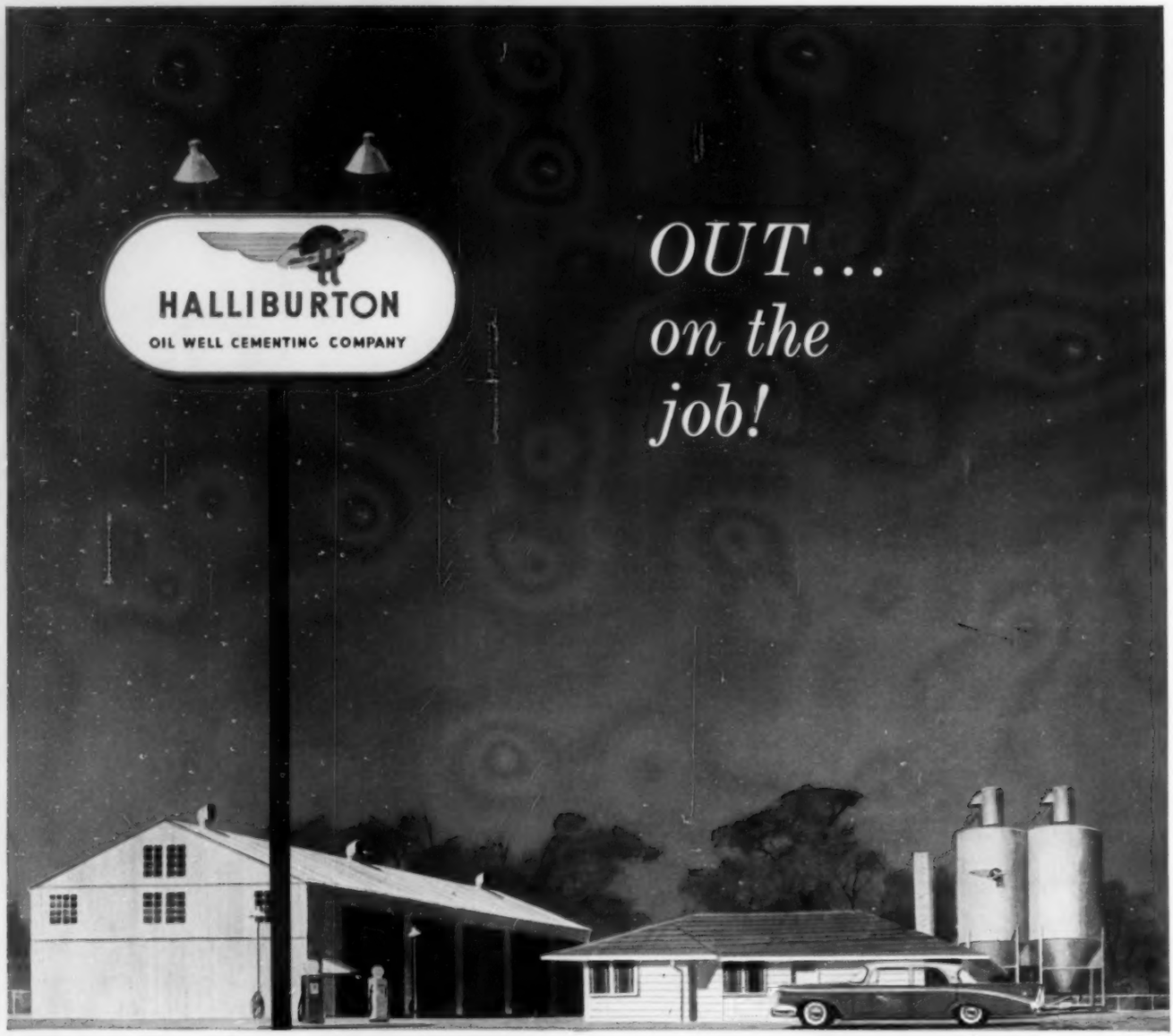
ROGERS *Geophysical Companies*

3616 WEST ALABAMA • HOUSTON, TEXAS

FOREIGN OFFICES

Edificio Republica • Caracas, Venezuela
Mogadiscio • Somalia
34 Ave. des Champs Elysees • Paris, France
1-3 Arlington St., St. James's • London 1, England
Hotel Castellana Hilton • Madrid, Spain
Tripoli, Libya • Algeria

ROGERS' CREWS GO EVERYWHERE



Everybody's out except the vitally important Radio Dispatcher who makes possible continuous coordination between Engineers, Cementers, and equipment wherever in the district they happen to be on a customer's job.

Halliburton maintains the most complete job coordinating facilities in the oil patch . . . 24 hours a day the camp is in constant touch with your requirements, ready to move men and equipment to the point where you may need it.

Call us first *for Service and we'll be there.*

HALLIBURTON OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

Prepared to meet the challenge

According to some of the better estimates available today, the next 25 years should be a period of great growth for the oil and gas industry in general and the exploration industry in particular.

Let's look at oil first and gas later. Cumulative world production and discoveries to date have been less than 500 billion barrels. Present demand is less than 7 billion barrels per year. By 1985, if widely used predictions are correct, oil demand should exceed 16 billion barrels per year and production during the next 25 years should total something like 300 billion barrels. This approximates the total of all known proved reserves at the present. In order to maintain efficient, economical production at a 16 billion-barrel-per-year level, known reserves should be say 500 billion barrels by 1985.

Since all past production and present known reserves total less than 500 billion barrels, we *should discover* more proved reserves during the next 25 years than we have discovered in all history to date! Can we do it? I think we can.

Now, let's look at gas. From the world point of view, the picture is not clear. For the USA alone, it has been estimated that we will get about 6,000 cu ft of gas for each barrel of oil we discover. For the USA, this means a future estimated gas supply of at least 1,200 trillion cu ft. This suggests that we must still find at least 80% of the gas we will eventually use in the United States—and we must prepare for a demand of over 20 trillion cu ft per year by 1985.

If we project these figures on a world-wide basis, it appears that we must still discover more than 12,000 trillion cu ft of gas. Something like 4,000 trillion cu ft should be discovered during the next 25 years. If we accept these long-term estimates, it seems that the job the oil industry faces during the next 25 years is large indeed.

We must discover enormous new reserves of oil and gas, and we must be able to produce these reserves at prices competitive with other sources of energy such as tar sands, shale oil, coal and nuclear power. Each of these energy sources is becoming less expensive—when compared with oil—year by year.

Here is a great challenge—and a great promise for future profit—for the entire oil industry. However, since my interests lie primarily with the field of exploration and discovery, let's confine the rest of this discussion to the exploration phase. If the geophysical industry is to meet the challenge, great strides in research must be made. For example, one of the greatest needs is a more reliable, less expensive way to survey large areas. Most of the earth has yet to be surveyed—even in a general way. Modifications of proven techniques and equipment or new methods are needed to do this job economically.

Next, present interpretive methods can be greatly improved to increase the quality and accuracy of subsurface mapping using present seismic gravimetric, and magnetic principles. This, too, is a massive research project that involves electronics, instrumentation, and computer application. Here again, millions of dollars are involved.

The exploration companies, the equipment manufacturers that supply them, and the oil companies must accept primary responsibility for the needed progress. This cooperative group will share in supplying the money and the research hours necessary.

Limiting factors at the moment are world market prices and local political decisions which curtail the income oil firms can expect from their investment. In many cases, the combination has all but stopped many promising development projects. Also governments—which often control markets as well as land—frequently set rules and regulations which have the effect of prohibiting efficient, orderly development of petroleum supplies.

It is vital that these governments create a political climate favorable to the development of adequate sources of energy at reasonable prices. Abundant energy is necessary to protect the world's growing population from mass starvation so the future of the oil industry—and the welfare of mankind itself—depends on wise decisions of governments involved in the discovery and development of oil reserves for the future.

The future of the oil industry lies, first of all, in the industry itself. The exploration division of the industry has met the challenge in the past, and is prepared to meet it in the future.

J. O. Hall

President, Society of Exploration Geophysicists

Hanging out seismograms to dry in a Sumatra jungle. Photo courtesy Texaco Inc.

Wildcatting is World Wide

Looking past the current crude surplus, oil companies are diligently prospecting in every corner of the globe to insure adequate future supplies.

DESPITE A CRUDE SURPLUS estimated at over one-third of present production, oil companies are jockeying for position around the world in an effort to add to their oil reserves. If estimates of increases in world oil demand are accurate there is good reason for their haste, since they forecast that the world will again be crude-hungry by 1964. At any rate, drilling became even more widespread in 1959 and early 1960.

Africa is the continent most likely to succeed to the title of Big Oil. We are witnessing a major transition in the international oil industry from the traditional three major sources (Middle East, USA and Venezuela) to one where four major sources will compete for world markets.

Other areas are not so fortunate. The Far East, more desperately in need of new energy sources than any other area, has had no recent major discoveries and drilling plans there do not indicate a major upturn in oil exploration activity. Latin America (Argentina excepted) seems generally in for a lean exploration year. That is particularly true of Venezuela, where exploration activity has declined to a surprising degree.

Europe, especially France, has become oil conscious. Activity is high throughout Europe, and seems slated to increase in Spain which has modernized her laws to permit international investment.

The Middle East is playing a particularly fascinating role in 1960. As everyone knows, the prices paid for the offshore concessions in the Persian Gulf were fabulous, and despite their size were based strictly on a guess. No one can know for sure that the oil-productive formations, which begin to thin out as they approach the Persian Gulf, extend out below the water in a significant way. There is a reasonable gamble that they do, but it remains to be proved. The wells being drilled offshore from Iran by IPAC and SIRIP will shed considerable light on the Gulf.

North America again declined relative to the remainder of the world in terms of geological and geophysical effort and wells drilled during 1959 and seems destined to continue to do so in 1960 and later years as production and exploration in more prolific areas continue to increase.

There follows a review of world exploratory operations, divided by major geographical area and by country.

Africa

Angola: Petrofina has had an encouraging oil find in the Galinda location in the Quissama game reserve in southern Angola. One source says the well was producing 600 b/d through a 1/16-inch choke. Galinda 2, 1.5 miles NE of Galinda 1 was producing 300 b/d through a 3/32-inch choke. At the Bom Jesus location in the game reserve, one well reportedly found oil and is under observation. Bom Jesus was drilling at 8,223 ft on December 12. Cacoba 4 drilling 36 miles SE of Luanda on the Cacoba structure had an oil show at 660 ft and was drilling at 1,098 ft in December. On the Cacuaco structure No. 9 is producing 80 b/d through a 3/32-inch choke. Cacuaco No. 10 was drilling at 5,148 ft. Uacongo 2b is a deviated well from the Uacongo 1 structure. It was drilling at 8,223 ft on Dec. 12.

Algeria (OCRS:) Activity with about 46 rigs has continued in Algeria, many of them exploratory. Cities Service is drilling with its French partners, and had its first exploratory well, Bou Aicha 1, below 5,000 ft on Jan. 6. 1960.

The Societe des Petroles de Valence, in which the BP Group has a 50% interest, has its first test well in the Sahara at El Arich el Megta in the Djorf el Atfal permit area. The well had reached 4,600 feet as of January 18, 1960. Two seismic parties are at work in the El Hassare and the Hassi Menkel permit areas, while three geological survey parties are operating in the Fort Polignac area in the extreme southeastern Sahara.

Phillips Petroleum Co. has a 25% interest in a wildcat being drilled in January, 1960 by COPEFA on the Hassi Touareg permit in the central Sahara, Algeria, at Longitude 6° 22′ E, Latitude 30° 32′ 25″ N.

Cabinda (Angola): Stratigraphic drilling is in progress by Cabinda Gulf but no wildcats are reported.

Egypt: Interest is growing in the Western Desert again as Libyan discoveries trend

Dynamite being brought by camels into a rugged area west of Tripoli where BP Exploration Co., Ltd., has been conducting exploration work since 1956. BP photo.

Libyans of the Marada tribe placing geophones for a seismic crew operating in the desert for Esso Standard (Libya) Inc. Photo courtesy Standard Oil Co. (N. J.)

that way. No drilling is underway as yet. Eastern Petroleum Co. is drilling up its Sidri find along the Gulf of Suez. The government is exploring with two rigs through General Petroleum Co. and plans to spend $11.2 million in 1960. Exploratory wells will be drilled at Rahmi and Ezz-el-Erban and later on the Sinai coast.

Gabon: Three exploratory wells were drilling at the end of 1959. FOREX spudded TC 18 on Dec. 16 and TC 19 on Dec. 21. SPAEF has a heavy rig drilling on RK 1, spudded Dec. 1. SPAEF and Mobil have drilled an offset well to the Rembo Kotto discovery which flowed about 28 bbls of light oil in two hours on drill stem test late in 1959. About nine rigs are running, plus two in the Middle Congo, of which five belong to SPAEF and the rest to contractors.

Ivory Coast: Plymouth Oil Co., a USA independent, is drilling its second exploratory wildcat. On Jan. 18, it was at 9,600 ft and drilling ahead with no shows reported.

Libya: 23 rigs are active and substantial discoveries have been made. The list of wildcats drilling includes almost every major company, but the most lucrative find to date has been Esso's Zelten field. The fourth well there found only about 1,700 b/d production but it did not go down to the water table. A fifth is now drilling.

British Petroleum was drilling Well A137 on Jan. 14, at 7,634 ft.

Mobil Oil had two wildcats drilling at the beginning of 1960. Dor El Musggaf-1 20 miles east of Dohra in Concession 11, was at 3,600 ft. El Hagfa, 80 miles east of Dohra in Concession 13 was at 7,500 ft.

At the beginning of 1960 Gulf was drilling two wells; D. 1.66 was at 5,458 ft and E. 1.66 was at 148 ft. Locations of these wells are 29° 28′ N, 12° 37′ E and 29° 4′ N, 12° 58′ E respectively.

Amoseas was drilling Scelua 1, about 80 miles south of the Gulf of Sidra, and was below 3,500 ft on Feb. 3, 1960.

Nigeria: A number of exploratory tests are being drilled by Shell-BP Petroleum Development Co. using an estimated seven rigs (including development). The company recently signed a 50-50 agreement with the government and during a press conference thereafter suggested production might reach 200,000 b/d. It was 15,000 b/d in 1959, will be about 30,000 to 40,000 b/d in 1960 when the Bonny terminal comes into operation.

During December 1959 Shell-BP spudded in five exploration wells and completed another three. Of the three completed, two were successful: Ibibio 1 and Alakiri 1.

Ibibio 1 (UYO Province) reached a depth of 9,179 ft and was completed as an oil well on Dec. 8.

Alakiri (Degema Province), which reached a depth of 11,490 ft was completed as an oil well on Dec. 13.

The dry hole, Umuowa 1 in Owerri Province, reached 6,803 ft.

During 1959 Shell-BP completed 37 exploration wells, of which nine are capable of producing oil. In addition, 16 successful appraisal wells have been completed.

Shell-BP has commissioned another seismic exploration party in the Western Region, where it is at work near the Ramos River, some 30 miles southwest of Warri. This brings the number of seismic parties working for Shell-BP in Nigeria to eight.

The government announced it would receive applications for concessions (Shell-BP is surrendering a number of areas in 1960) beginning March 1, 1960. The more promising areas remain under Shell-BP control.

Mobil Oil drilled a dry exploratory well and abandoned it during early 1960. Another is now drilling on Mobil's license area.

Tanganyika, Kenya, Zanzibar: British Petroleum is the only explorer in the drilling stage within these countries. No wildcats were drilling at the beginning of 1960. Pemba 4 well was completed for geological information on August 7, 1959.

Somaliland Protectorate: Berbera 1 was completed for geological information Dec. 19, 1959 at 2,530 ft by British Petroleum. Five tests will be drilled in 1960.

Stanvac will drill Biyo Dader, directly north of its Dagah Shabell wildcats. Las Oureh was drilling directly west, and had reached 796 ft as of Jan. 16.

Somalia: ENI, the Italian government's company, is on its fourth wildcat (previous three were dry). No shows have been reported. Sinclair Somal Corp. is drilling its

Rock bits being unpacked at Port Campbell, Australia, for service in the wildcat drilled by Frome-Broken Hill Pty. Ltd. Photo Courtesy Petroleum Information Bureau (Australia).

Shooting boat entering the port of Agadir, Morocco, which was operations base for Western Geophysical Company's Party 74 base during recent offshore reconnaissance work. Photo by Western Geophysical Co.

fifth test, Duddumai. The fourth was Merca 1 which went below 11,000 ft and was dry.

Standard Vacuum is doing surface work only. Frobisher oils has an exclusive permit southwest of Sinclair and a Denver independent, Merritt C. Orr, has a non-exclusive right in the same area.

Senegal: Two exploratory tests were being drilled for SPS during late 1959. Diourbel 1 is in the north central part of the country and Kolobane 1 is about 30 miles east. Two French seismic parties and a BP seismic party are at work for SPS.

Continental Oil Co. and Cities Service Co. have joined French companies in exploration over some 3,400,000 acres. The arrangement was announced in December, 1959.

Ethiopia: A German company, Elwerath, has taken a concession and will begin surface work during 1960.

Belgian Congo: No wells are drilling. A new company, Syndicat pour la Recherche de Petrole da Bas-Congo has taken a concession and is making preliminary soundings in the Mayumbo.

Tunisia: The only company drilling is SEREPT. Conorado has concessions and has started seismic work. SEREPT has two rigs running, and has drilled almost 40 dry holes with only some gas production to show for them so far. Mobil obtained an interest in SEREPT's permits during late 1959. SEREPT will continue as operator.

Middle East

Abu Dhabi: Abu Dhabi Marine Areas Ltd. was testing its latest Umm Shaif well at 10,150 ft on Jan. 14. The well was completed November 30. The company is not known to be doing any exploratory drilling at present, the Umm Shaif wells are step-outs from the original discovery.

Bahrain: No exploratory wells are drilling.

Dhofar: Cities Service and Richfield are drilling two wells: No. 1 SE Mazraq, 23 miles NE of Marmul 1, was drilling below 4,000 ft on Jan. 6. Jarf 1 was drilling 26 miles east of Marmul 1, below 4,500 ft on the same date. Neither has reported any significant discovery.

Iran: Several important wells are drilling in Iran: one by IPAC, affiliate of International, owned by Standard Oil Co. (Indiana) and the other by SIRIP, affiliate of ENI, the Italian goverment's company.

Pan American is drilling IPAC A1 from a well-equipped offshore platform. At last report (mid-January 1960) the well was below 8,990 ft and drilling ahead with casing set at 8,500 ft. The well should be below the Asmari limestone now, but no production has been reported. It is probably shooting for the Cretaceous, a worthy target, as proved January 1959 when the Consortium's Ahwaz No. 6 flowed 10,000 b/d or more from the Cretaceous at 10,900 ft.

SIRIP is drilling two wildcats simultaneously—one on top of a mountain and the other below the Persian Gulf. Sirip No. 1 offshore well in early January was down to 6,373 ft and casing set at 6,363 ft. The wildcat on top of Mount Sequta was held up by a heavy snowfall and has not progressed far as yet.

The Consortium is drilling several wildcats. At the end of 1959 Binak 1 was at 10,822 ft and 2 was at 5,500 ft. Binak No. 1 had very good shows of 24-gravity oil at 10,817 ft.

No. 1 Suru, the Consortium's first wildcat at the eastern end of its operating area, was drilled nine miles northwest of Bandar Abbas. The Consortium will spud a 15,000-ft test to seek deeper production in its shallow Jasijid-i-Sulaiman field.

The government, through NIOC, was drilling several wells at the end of 1959. Sarajeh No. 3 was past 8,658 feet with a plug set at 7,964 ft. Sarejeh No. 4 had reached 10,007 ft and was coring. NIOC made its second oil discovery in this field during February, 1959, when Serejeh No. 2 came in with an open flow potential of about 2,800 b/d of crude and around 40.5 mmcf of gas.

NIOC is proceeding cautiously at Alborz where tremendous pressures caused a spectacular blowout on discovery. Alborz 8 has a drill pipe stuck at 9,923 ft but as of the end of the year had been cleaned out and drilling was continuing. A stratigraphic well by NIOC at Gorgan 1 had reached 3,580 ft in mid-December 1959.

Iraq: Five exploratory wells were drilling in Iraq at the beginning of the year as listed below:

Well		Date Spudded	Depth Jan. 3, 60
Iraq Petroleum Company			
Pulkhana	6	November 1959	1,780 ft
Gilabat	2	December 1959	2,004 ft
Basrah Petroleum Company			
Tuba	1	March 1959	11,939 ft
Kifl	1	September 1959	4,746 ft
Mosul Petroleum Company			
Samarra	1	July 1959	8,410 ft

Israel: No deep wildcats are known to be drilling. Naptha-Israel Petroleum Corp. is planning 20 development wells following its Sohar gas discovery.

Jordan: Phillips Petroleum Co. is drilling

British Petroleum Co. has been exploring in East Africa jointly with the Royal Dutch/Shell Group. Pictured is a deep test well at Mandawa on the southern coast of Tanganyika. BP photogrph.

BP Exploration Company (Libya) Ltd. halts a convoy in the desert at night to ensure that all vehicles still are in the convoy. BP photograph.

its sixth wildcat, the first on the acreage recently acquired. Location is near Karak in the Dead Sea region.

Kuwait: Minagish 1 was completed in 1959 as a Ratawi limestone producer but is now shut in to await installation of facilities for a production test. No. 2 is now drilling at a site a mile southwest of the discovery. Dibdibba 1 was abandoned in the Mauddud lime. Muturi 1 was shut down in November but a new deep test will be drilled on this structure.

Muscat and Oman (Excluding Dhofar): Petroleum Development (Oman), IPC affiliate, is drilling a deep exploratory test, Haima 1. On Dec. 23, 1959 it was at 10,656 feet. No shows have been reported.

Neutral Zone: Arabian Oil Co., owned by Japanese interests, which obtained similar concessions from Kuwait and Saudi Arabia to drill offshore appears to have a substantial discovery in its first wildcat. Early reports are that the well is capable of producing upwards of 6,000 b/d from the Cretaceous, the same formation which produces in the nearby Safaniya field offshore from Saudi Arabia. Rig which started drilling this well was destroyed by fire when the well blew out at a shallow depth. The platform itself was saved and drilling resumed after repair. Another Japanese rig is being brought in for a second test.

No exploratory drilling is being done onshore in the Neutral Zone.

Qatar: Dukhan 65, the country's only land exploratory well currently drilling, is a deep test which at the end of 1959 was at 13,261 ft. No shows were reported. Rigging-up was approaching completion on Jan. 4, 1960 to drill Dukhan 66.

Shell Co. of Qatar Ltd. is making its second attempt to find oil offshore since its first drilling platform was destroyed by a storm in December 1956. The platform had drilled two wells, both dry. Shell built another platform in Germany and towed it out during 1959; it arrived on Dec. 5 and is drilling another exploratory well at present.

Saudi Arabia: Only one exploratory well was drilling in Saudi Arabia proper as the year came to a close. That well was Aramco's Abu Hadriya 5, down to 9,595 ft on Dec. 30 and drilling ahead. The company reported oil in the Arab Zone, which had not been proven productive in the four wells previously drilled in the Abu Hadriya field.

Syria: The Deutsche Erdoel-Aktiengesellschaft is actively drilling with three rotary rigs. As of Dec. 31 Tachembe 1 was at 2,747 meters and drilling in the Cretaceous. Souedie 2 was at 1,049 meters and in the Eocene (Souedi 2 is about 4 kilometers east of Souedi 1). Toueman 1 was at 2,123 meters and in the Cretaceous.

Turkey: The oil boom is slowing down, as the dry hole count continues to mount. Some of the smaller companies have pulled out of the country after a series of disappointing wells. So far, only one find has been made and it is not considered commercial. That was at Khata by Amoseas. As of Feb. 3, 1960, Amoseas was testing its fourth well there.

Gulf is drilling one wildcat, Murefte 1. Jan. 1 depth was 6,800 ft. Location is 40° 42′ N, 27° 04′ E.

Trucial Coast: Murban 3 was drilling at 2,883 ft by Petroleum Development (Trucial Coast) Ltd. on Jan. 3, 1960.

Asia And Australia

Australia: Interest is centered on the deep Betoota well being drilled by a group composed of Santos Ltd., Delhi Australian, and Frome-Broken Hill Pty. The previous test was dry. On the opposite side of Australia, heavy rains have held up the progress of WAPET, which spudded Thangoo 1A Dec. 21, 1959. One of the more interesting exploratory results was the discovery of dry gas by Australian Oil and Gas Corp. at Camden, New South Wales.

British Borneo: Exploratory drilling is conducted by companies of the Royal Dutch Shell Group. Two dry holes were completed in 1959. At the beginning of 1960 the company had one exploratory well drilling; Engkabang 1, by Sarawak Shell in Sarawak. It was at 10,854 ft and drilling ahead.

A new offshore movable platform, the Orient Explorer, arrived in June 1959 and the first well was spudded in on August 27 approximately 7,400 ft offshore from the East Seria field. It was drilled to 6,280 ft and a second was spudded October 5 at a location in the western part of the Seria field, approximately 7,800 ft offshore. After a third well in this area has been drilled, the Orient Explorer will be used for exploration drilling on the continental shelf.

Burma: Exploratory drilling by Burmah Oil has only been underway since the Ondwe well in Magwe district was drilled in 1958. Since then four more dry wildcats (with gas shows at Ondwe and Deday) have been drilled. The company recently purchased an additional drilling rig, which will go into action during 1960.

The Burmah Oil Co. (1954) Ltd. and the

(*Continued on page* 80)

Killing three birds with one stone

Robert J. Riggs, manager of the seismic reference service division of Century Geophysical Corp., joined the company in 1957 after being engaged in consulting work during the previous three years. He was with Carter Oil Co. from 1947 to 1954. Mr. Riggs is a native of Tulsa and received his education at Dartmouth and Columbia.

by Robert J. Riggs, Jr.

The Sonic Log is a useful tool for the geologist, the engineer, and the geophysicist. Here the geophysical values of the log are amplified.

SELDOM IN THE HISTORY of wire line logging has a system enjoyed such rapid and wide acceptance as has sonic logging. Considering that this system is at once the tool of the geologist, engineer, and geophysicist, such acceptance is readily understood.

The reliability of the sonic log as a quantitative tool for porosity studies has been clearly demonstrated. When the sonic log is used in conjunction with resistivity measurements, saturation values may be computed. Qualitative uses of the tool include lithologic identification and correlation studies. A "fringe benefit" of this log is that perhaps no system yields so readily to interpretation by inspection. The untrained or inexperienced oil man can easily acquire an ability to appreciate porosity variation and lithology changes by "eye-balling" the sonic log.

Sonic logging is a precision measurement of the time required for an acoustic impulse to traverse a definite length of the formations encountered in drilling. This travel time is the reciprocal of the velocity (i.e. the speed of sound) in these formations. The sonic log presents the relationship between velocity and formation more intimately than any other form of measurement. It is the only logging technique where the measurement is sensitive only to the rock between the sensing points on the tool. Therefore, uniquely the sonic log is not affected by adjacent rock outside the measuring span.

Since the log records the travel time of sonic energy through the formations on a continuous basis, the total travel time of sonic energy through the entire section logged is determined by an integration process (i.e. an accumulation of all the instantaneous velocities logged). Total travel time thus arrived at is of value to the geophysicist. When this data is used together with seismic check shots taken independently of the sonic log at various levels in the borehole, it is possible to adjust these measurements within the exacting tolerances required by the geophysicist. The absolute times established by the seismic check shots allow the integrated time values shown by the sonic log to be verified and adjusted where variances from geophysical standards exist. Also, the seismic check shots are the best means of establishing a time tie between the ground surface and the start of the logged section.

Figure 1 is diagrammatic of this process. At the time logs are being run on the well, specialized seismic equipment is set up at the wellsite. Usually shot holes are drilled on two opposite sides of the well. A pressure sensitive geophone is lowered into the well and stopped at various levels. This geophone may be affixed to the top of the sonic probe and thus be made a part of the probe itself. At the check levels, seismic shots are taken as the well geophone and sonic probe are lowered in the hole. When total depth is reached, the check shots operation is complete and the probe is ready to record the sonic log on the trip out of the hole. Such a procedure allows the check shots and the sonic log to be taken by only one round trip into the hole.

Figure 1 illustrates three such check levels surveyed. Sonic energy from a detonation of explosives in the shot holes travels a diagonal path to the geophone in the hole and thus establishes a diagonal time tie from the shot point to the geophone. This time is converted to vertical time by trigonometric means. By this method an accurate time from a datum to selected levels is recorded. In the example shown, a sonic log has been run from total depth to the bottom of the surface casing. The total travel time of sonic energy through this logged section is shown by the calibration marks down the left side of the log. These marks represent the measuring of the area under this interval time curve and the recording of a mark at each point where a millisecond of time is accumulated.

The three check levels in Figure 1 are assigned corrected time values derived from the seismic check shots of 0.772 second, 0.533 second, and 0.165 second reading from the deepest check level to the shallowest. Since the check level nearest the bottom of the well was established as having a total travel time of 0.772 second from the datum, the calibration mark on the integrated sonic log at the check level depth must also have a time value of 0.772 second. Each of the calibration marks on the integrated sonic log are one millisecond apart, so therefore, the mark immediately above the 0.772 second check level must be 0.771 second . . . the mark above that 0.770 second, etc. If interval times as measured independently by the seismic method and the sonic method

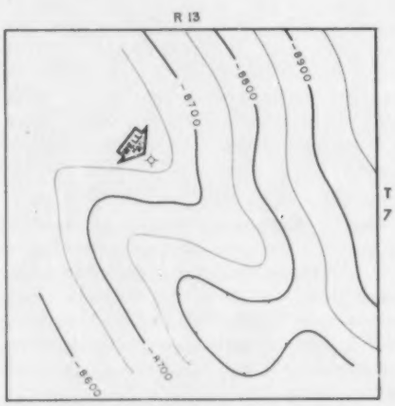


Fig. 3—Structural Map based on reflection Seismic Survey with limited Velocity Control.

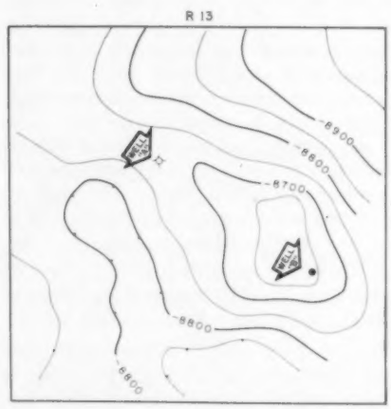


Fig. 4—A re-interpretation of the same reflection Seismic data used in Fig. 3 but incorporating Geophysical Log Control.

were in complete agreement, a counting of the calibration marks in this manner would end up reading 0.533 second exactly opposite the 0.533 second seismic check level. This is seldom, if ever, the case, because the accuracy tolerances of the seismic method exceed those of the sonic method. The amount of mistie between sonic and seismic is calculated using the system outlined above. There are several ways to reconcile sonic-seismic misties, but generally a prorated or linear distribution of error is used. When sufficient geological-geophysical information is available, it is often possible to introduce non-linear corrections to resolve misties.

Essentially, resolving misties between sonic values and seismic check level values is a problem of curve fitting. An integration of the corrected curve will result in an adjusted or corrected line of calibration marks that are recorded down the right hand side of the log.

Figure 2 shows an actual segment of a geophysical log. Either a gamma ray or a spontaneous potential curve is generally presented for correlation. In this example, a gamma ray curve is shown. Down the center of the log are the calibration marks recording the integration of total travel time from the field run of the sonic log. Down the right hand side of the log are the calibration marks showing the integration of total travel time after adjustment to the more accurate seismic check shot values. Check shot levels and computed times are spotted on the log as shown by the illustration. This procedure has proven the high precision of measurement inherent in a sonic log.

The sonic log is recorded in the field using a linear interval time scale. The geophysical log shown in Figure 2 uses a linear interval velocity scale. Velocity is the reciprocal of time so the sonic log curve (microseconds per foot) is converted to the geophysical log curve (feet per second). When the geophysicist uses the log, it is much easier for him to deal in velocities than times.

From such a log the geophysicist can pick the total travel time from datum to any depth or horizon logged. He is thus able to calculate correct average or interval velocities. Correct velocities are fundamental to the proper interpretation or re-interpretation of seismic data.

An average velocity must be known to convert reflection times from subsurface horizons, as recorded on field seismograms, to subsurface structural depths. If the velocity used is in error, regardless of the quality of the field seismograms, an inaccurate interpretation of the subsurface structure will result. Velocities to reflecting horizons in a geologic area do not remain constant. Velocity gradients are the rule rather than the exception in all geologic provinces. Figures 3 and 4 illustrate this point. This example is simplified and hypothetical, but it approximates actual maps prepared using velocity control obtained from wells drilled in an area.

Figure 3 shows a sub-sea structural map contoured on 50-foot intervals. Data for the construction of the map came from a reflection seismic survey conducted over this township. In converting time values of the reflection horizon to true sub-sea depths, a constant average velocity was used. This average velocity was obtained from the nearest geophysical log available.

The record quality was good. Well "A" was located and drilled on a high point of the structural nosing developed. A dry hole resulted in the objective horizon with salt water shown by the drill stem test. Included in the logging program on Well "A" were geophysical check shots taken in connection with the sonic log resulting in a geophysical log such as is shown in Figure 2.

The geophysical log on Well "A" then allowed a re-analysis of velocity data in the area. From this data velocity gradient map was contoured. By using this gradient map to convert reflection times to depth, a corrected interpretation was made as shown in Figure 4.

An anticlinal feature with approximately 100 feet of closure was mapped southeast of Well "A". Well "B" drilled on this anomaly was a discovery well. This reinterpretation of the subsurface as shown by Figure 4 was based solely on geophysical log data. No additional field seismic work was required and the corrected time values originally picked on the seismograms were used throughout. The additional logging cost occasioned by taking a geophysical log as opposed to not taking a geophysical log, was less than $2000.

The geophysicist has other important uses for seismic-sonic data. Changes in lithology largely control the wave form of impulses generated and recorded during routine field seismograph operations. The geophysical log

(*Continued on page 92*)

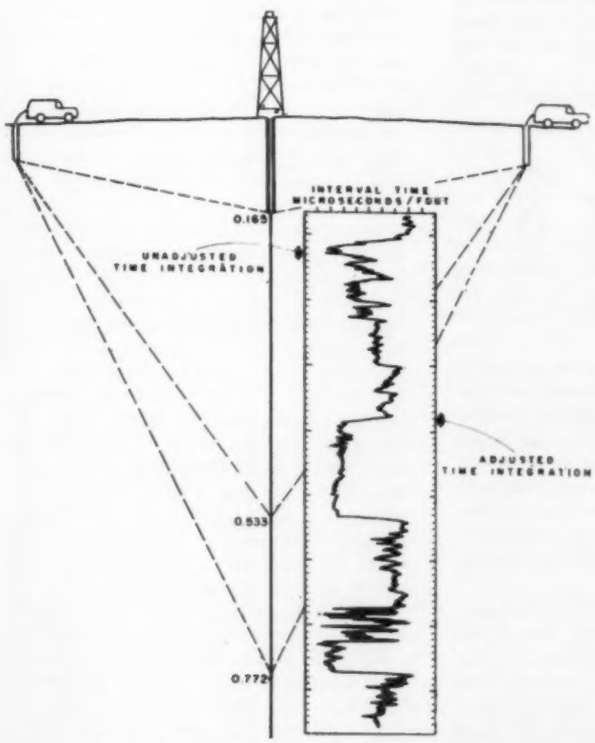


Fig. 1—Diagram of the Sonic-Seismic Logging process.

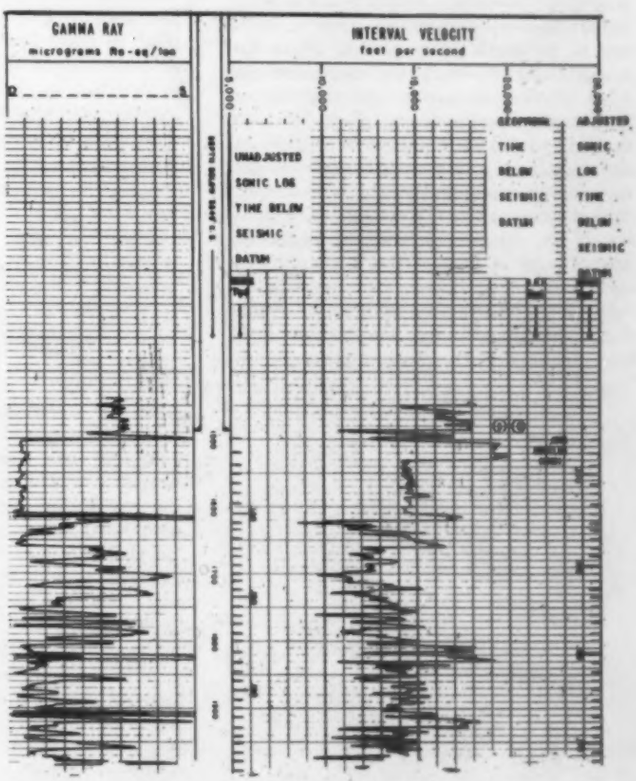


Fig. 2—Segment of a Geophysical Log which includes Sonic and Seismic Data.

The human side of geophysics

by Lloyd Paitson

EXPLORATION GEOPHYSICS requires machinery. Even the most basic geophysical application needs a mechanism with which to measure some physical property of the earth. This contrasts with exploration geology which, in its simplest form, can be pursued with no equipment beyond functional legs and eyes and some mental facility. In any human effort, continual use results in occasional misuse; and in the geophysical profession's use of machines, the misuse takes forms varying from clumsy application to fraud.

The fraud, epitomized by the mystical black box, has a purity of purpose which sets it apart from the other abuses. The effort which is purposely and totally bad commands more respect than that which is just sloppily bad. Black boxes are used to defraud the ignorant and are not a problem seriously affecting the geophysical profession, because the naive people who buy black boxes are not usually buyers of ethical geophysics. But all the other abuses of the machinery of geophysics are problems of serious concern to the profession.

We can define two broad areas of endeavor in exploration geophysics. The first involves the problems of securing basic data. Ideally this effort should start with a geologic concept assigning commercial significance to a measurable physical property of the earth. If we plan to search for a particular material, we must consider what physical uniqueness the material or its immediate environment offers. Next we develop or adapt equipment capable of detecting the quality and, if possible, the quantity of this uniqueness by a distant, or distantly controlled, observation. The density of or velocity in salt and magnetic susceptibility of magnetite are examples of such uniqueness. If we fail to establish a relationship between the material or condition being sought and the measurement being made, or if the measurements are too

course to detect significant variations; then we are misusing the machinery.

In the second aspect of geophysics, the interpretation of the basic data, more serious violations are possible; because here we have occasion to use, and a corresponding opportunity to misuse, many accessory machines. After the geophysicist has made his basic measurements he needs only a pencil and time to proceed to the ultimate refinement of interpretation, but he finds so little pleasure in the intervening arith-

metic or routine drafting that he soon develops or adapts various mechanisms to aid him. The only honest function of such accessory equipment is to reduce the cost of the interpretation by relieving the geophysicist of some routine tasks or expediting the data presentation.

In pointing to possible misuses of machines we need consider only the application of geophysics to petroleum exploration. The misuses are more numerous in this application not only because of greater use but also because geophysical methods are applied to the search for local environment of hydrocarbon accumulation rather than to detection of the material itself. In this indirect search, cause and effect relationships often become vague and distorted by

imperfect understanding and inept application. A successful search results from intelligent interpretation of reliable basic data. Accessory machines never find oil fields. The role of slide rules, calculators, electronic computers, magnetic recordings, magnetic "playback" mechanisms, and other appurtenances should be based on economics only. Their purpose is to reduce the cost of finding an oil field.

The decision to use accessory tools varies in importance directly with the cost of the tool. No one argues against the use of the slide rule or the calculator, because their cost is insignificant. But the cost of adding magnetic recording and "playback" to a seismic crew, three to four times the interpreter's salary, is most surely significant. Does the addition of magnetic recording enable one seismologist to do the work of four and do it better? Do four seismic crews equipped for magnetic recording find more oil than five crews which are not so equipped? These questions are important because they present realistic ratios of cost. They should be considered before magnetic recording equipment is added to a seismic program. Thus far, the questions have been occasionally asked and rarely answered; and so magnetic recording equipment may have been misapplied more than applied.

Similarly, the new electronic computers have been subjected to some gross misapplications. These devices were designed to per-

form arithmetic operations with great speed. It it is required that a body of data be subjected to a series of arithmetic operations yielding a family of answers, these machines may be very useful. If a single answer obtained by one or two operations is sufficient, then a slide rule or adding machine may be the proper tool. In the geophysical techniques which measure variations of magnetic and gravitational fields, it is frequently convenient to prepare several map presentations from a set of basic data. "Derivative" and "residual" mapping techniques have been devised to provide different views of the data. The geophysicist might wish to look at these accessory maps for much the same reason that a horse trader looks at the other side of the animal before he buys. And just as there is a limit to the number of sides of a horse, there is a limit to the number of useful maps which can be prepared from a set of data. The preparation of these secondary maps may require a lot of arithmetic. It is the geophysicist's responsibility to decide what maps are needed and then to select the procedures and machinery best suited to their preparation. He may discover that the use of an electronic computer is more expensive for his purpose than some other methods, but that it can provide him with a number of variations of the desired answer at no additional cost. In short, for some extra money he gets data from which he can prepare twelve more maps repre-

senting variations of his basic data. But that computing machine can no more create twelve *useful* views of the basic data than it can give birth to a twelve-sided horse. If the geophysicist needed those twelve maps to find an oil field, he should have been preparing them even before the invention of the machine which can produce them cheaper by the dozen. Mass production techniques are fine for canning beans but not for interpreting geophysics.

Petroleum exploration geophysics is a commercial science which must exist within a framework of supply and demand and justify its existence in the marketplace by barrels of oil discovered. The laws of the business world do not restrict the geophysicist's application of natural laws to his science. Commercialization has not, of itself, stained the purity of geophysics; but it is true that some poorly applied geophysics have been commercially successful. The laws of cause and effect which govern the business world appear crude and arbitrary in comparison to the physical laws which frame the science of geophysics. When $100 million worth of oil has been added to its reserves, an oil company's management may not care whether the geophysical cost of the discovery was $1.1 or $1.2 million. Thus, a geophysicist's $100,000 mistake passes unnoticed, and he is free to repeat a professionally inept performance because it was

commercially acceptable. However, this commercial framework changes constantly. The world's undiscovered reservoirs are being discovered, and each can be discovered only once. Inevitably, the elbow room between the professionally perfect and the commercially acceptable performance narrows, and the geophysicist who acquired his sense of responsibility in the marketplace rather than within the narrower framework of his science begins to feel the squeeze long before his profession actually is threatened with obsolescence.

Apparently this squeeze has been felt by some in the past few years. The reactions show signs of panic. The evaluations of fellow human beings is the sorest task of management. The exploration manager charged with discovering the world's undiscovered petroleum suffers under the knowledge that his success depends upon the talents of the people around him. Now if this man is pressed, on the one hand, to improve his oil-finding efficiency and is offered, on the other hand, machinery of a complexity beyond his immediate understanding, he may be tempted by the thought that such mechanisms might supplement, or ultimately replace, the required human talent. So, he buys the machinery and fires some people or, at least, sacrifices some of their productive time to the task of tending the machines. It he sacrifices people who performed their work with pride and ability and who were capable of making decisions, then perhaps it is a logical next stage that his company begins buying all of its oil fields instead of finding them.

Exploration geophysics is a commercial service which must be sold to be applied. There is always a buyer-seller aspect to a geophysical program; and it involves the oil company's management, its exploration managers, its geologists, its geophysicists, its laboratory directors, each selling his own ideas and appraising those of the others. The geophysical contractor may enter this group at any level to deliver his sales pitch. Salsemanship is a vital part of free enterprise; and in a slow, mill-of-the-gods fashion it probably helps grind out rewards for the justly successful competitor. But the staunchest advocate of salesmanship must admit that the sort of truth which is represented by the laws of physics, for example, is not in the realm of the salesman. His reality is present success. The seller of geophysics shares the knowledge with all salesmen that the attractive power of his prod-

uct is sometimes as important as its performance. How does he attract attention to his product? As a geophysicist, he knows that he can offer little more than his own talents and those of the people in his organization. But as a salesman, he knows that the prospective buyer is often thoroughly bored by a description of those talents. He knows also that his prospect is too sophisticated to buy a program just because it offers two-toned paint jobs and tail fins on the trucks. However, sophistication is bounded by knowledge, and in that twilight zone at the edge of some prospect's understanding he may become intrigued with two-toned cir-

cuits and electronic tail fins and thereby become a buyer. This may explain a portion of the geophysical profession's current use

Lloyd Paitson entered the geophysical profession in 1943 and for the next eight years he worked on seismic field parties as surveyor, observer, computer, and party chief. Since 1951 he has supervised seismic crews in many of the petroleum provinces of the continental United States. At the present time Mr. Paitson supervises domestic seismic and gravity operations of Geophysical Associates International, Houston, in which firm he is a partner.

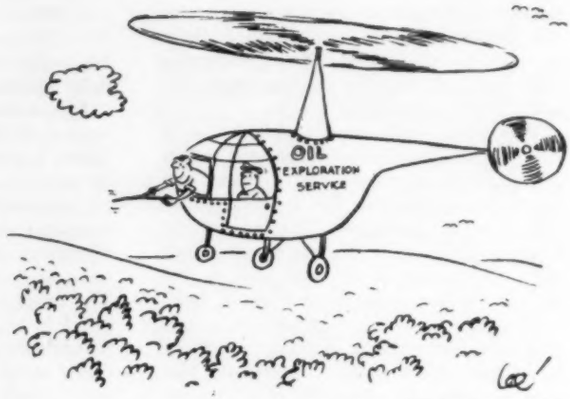
of embellished and accessory machines; they are being aggressively sold.

In the automotive industry, the tail fin will go the way of the hood ornament, because it is not a functional part of the product. If buying power were depressed, such costly embellishments would suffer quick extinction. Domestic geophysics has at present a depressed market which suggests a need for a critical evaluation of embellishment. And no matter what cyclic fluctuations lie ahead, there is one descending curve which must ultimately trap us. That is the curve which represents the diminishing number of undiscovered oil and gas fields. Sooner or later, the geophysical profession will be denied the luxury of an indulgent management and will be unable to support promotional embellishment.

The geophysicist is at present surrounded by machines which were acquired for many reasons: of necessity, for convenience, by indirection and misunderstanding, or as a result of sales promotion. Some of this paraphernalia may prove valuable and some may not. When the chips are down and the oil industry can afford geophysics only in its most efficient form, what will be used? There will be the basic machines—probably those we know now and just possibly some new ones. Beyond that, only one thing is certain: there will be a man with a pencil.

NEW TOOLS FOR THE GEOPHYSICIST

The airborne gravity meter now permits simultaneous magnetic and gravity surveys, a boon to geophysicists operating in remote jungle and desert. New energy sources permit deeper continuous marine profiling



From "Oil Fun" copyright by Batoafse Internationale Petroleum Mij.

NEW EQUIPMENT and new techniques in aerial and marine reconnaissance have featured geophysical progress in the past year. On water new energy sources have been employed for mapping subsurface features at greater depths. In the air an airborne gravity meter has been developed to the commercial stage with sufficient accuracy to permit simultaneous, high speed gathering of magnetic and gravity data. An airborne gradiometer has been announced by a Canadian geophysicist although accuracy data has not been released. New methods of positioning planes without the use of ground stations are of importance in aiding aerial reconnaissance.

Reporting to the recent annual meeting of the Society of Exploration Geophysicists, J. E. White of Ohio Oil Co. and Frank Press of California Institute of Technology, said that "undoubtedly the most exciting developments in the techniques of gravity measurements have been the demonstration of accuracies which can be achieved aboard surface vessels and in airplanes."

As described in some detail elsewhere in this issue Fairchild Aerial Surveys, Inc., La Coste and Romberg and Gravity Meter Exploration Co. in a joint enterprise to be known as FLAGS have been wrestling with the problem of putting gravity meters in the air. It was not an easy one to solve.

Any gravity measurement in the air is subject to disturbance due to acceleration of the aircraft. Even under very good atmospheric conditions these disturbances amount to the equivalent of hundreds of thousands of milligals. The successful measurement of gravity in the air depended on the development of means by which the short period motional effects could be measured and eliminated by smoothing or averaging over appreciable time periods. Under good flying conditions, values with a precision of 10 milligals can be obtained with averages over two to three minute periods, which, at usual flying speeds, correspond to distances of six to ten miles on the ground. Some indications of changes over shorter distances may be obtained by using running averages which overlap adjacent periods. There are additional accelerations from short period changes in elevation and the speed of the plane over the rotating earth, the Eötvös effect. These can be determined and eliminated by very accurate navigation for determination of speed and course and by precise measurement of changes in elevation. Taking all these effects and corrections into account, it is estimated that, with present observation and data reduction techniques, the airborne measurement may be equivalent to accurate ground stations at 5-mile intervals.

At the recent conference at Calgary to consider resources in the Canadian northland Dr. Hans Lundberg of Toronto, announced an airborne gradiometer which he said would become a valuable tool for mining and oil exploration in the arctic.

The Lundberg gradiometer is basically a sensitive electric balance composed of two substantially similar masses suspended on thin filaments one above the other. A variable condenser is located near the two masses. When the instrument is flown over density differences the masses change their position relationship. This movement may be measured electronically very accurately to a hundred millionth of a centimeter. Geological masses or conglomerations of masses that have different densities from their surroundings are thus identified by movement of the electrical mechanism. The instrument has not been described in detail or opened for inspection to geophysicists.

Some three years ago Socony Mobil Oil Co. developed the Sonoprobe for continuous profiling of subsea formations. The system was effective only at shallow depths and hence had a somewhat limited application in geophysical reconnaissance.

More recently Socony's Dallas laboratories have devised a more effective means of imparting energy to the subsea formations while retaining the low cost, continuous features. The present seismic system employs under-water explosions in a gun fueled with a liquefied petroleum gas and oxygen.

The method is a one-boat operation which employs the detonation gun as a source of seismic energy for obtaining variable-density records in a repetitive manner as the boat moves at a uniform speed. In the Gulf of Mexico and in the bays along the coast, records consistently show good reflections from depths of 4,000-5,000 ft., and in some areas reflections from 8,000 ft. or more.

The source of energy is a detonation gun 20 ft. long and 6 inches in diameter, which is fed a fuel mixture of propane and air, or propane, air, and oxygen. A spark plug initiates a detonation of the fuel which develops a shock wave that strikes the water at the submerged end of the gun.

Seismic signals from a line of pressure detectors towed behind the boat are fed to a conventional seismic amplifier and thence to a magnetic-drum compositor. Each shot is recorded on the magnetic drum, and the sum of two or more channels (up to a maximum of 16) are added for output to variable density and magnetic tape records.

Electro-sensitive paper is employed for the variable density section since this permits viewing the signals as they are recorded. The section is then a series of 3.0 sec. seismic records across 18-inch paper, with variable density traces spaced 1/64 inch to give the appearance of a continuous section.

A standard high-fidelity stereo magnetic tape recorder records the output of the

magnetic drum compositor or the uncomposited signals direct from the input seismic amplifier. These are played back as conventional seismic records or as variable-area or variable-density record sections with the filtering and compositing of the operator's choice.

Two years ago Louis R. Padberg Jr. of the U. S. Navy electronics laboratory in San Diego, Calif., published a report in WORLD PETROLEUM[2] describing the use of repetitive sound sources to replace explosives. He used an underwater electric spark for offshore surveys.

Within the past year a spark source developed by J. B. Hersey and S. T. Knott of Woods Hole Oceanographic Institution and added to by W. C. Beckman and others at Lamont Geological Observatory, has been used commercially for continuous seismic profiling at depths from 400 to 1,200 ft. below the ocean floor.

In this method a single boat is used to tow one or more hydraphones and a sound source employing a 10,000-volt spark. The two are positioned about 20 ft apart at a distance some 200 ft behind the boat which cruises at 3 to 8 knots. Total weight of the equipment is about 900 pounds. Data is recorded directly in the form of a geologic cross section and requires little interpretation.

Scientific Service Laboratories Inc. also has a continuous section recording system employing the sonic reflection method for continuous near-surface profiling—at depths ranging from 300 to 1,000 ft. Rayflex Marine, Inc., Dallas, is using the equipment as part of the "Omni-Search".

Chemical methods now are being employed as an aid in the search for oil and gas offshore. Atlantic Refining Co. developed the Marine Seep Detector which has been employed commercially. Atlantic researchers reasoned that as gas bubbles rise from underwater seeps small amounts of methane are dissolved in the water and currents spread the methane enriched water into a long plume.

A boat sailing at right angles to the current samples the water continuously. The samples are examined in an infrared analyzer for methane content and the seep thus tracked down.

Velocity logging is growing in popularity as an aid to the geologist and geophysicist. Century Geophysical Co. at Tulsa is offering a logging service from the grass roots to the producing horizon. An article elsewhere in this issue discusses the methods used and the results attained.

A nuclear magnetic log has been developed which can be used to determine effective porosity and which distinguishes between oil and water zones and indicates oil and water saturations in the immediate vicinity of the borehole. Tests have been run in a considerable number of wells in various areas in the USA.

Another promising new development is an electric logging tool capable of being pumped down the drill pipe and out through the bit. After records are made the tool is retrieved with a wire line.

In their review of technological developments for the SEG previously mentioned, Messrs White and Press discussed the growing use of computers as an attractive means of making routine computations on seismic data. They reported that "starting with reflection times read from records in the conventional way and punched into cards, one group has used a digital computer to compute true depths for as many as 13 reflection events, with automatic plotting of the depth points. Velocity functions may be changed readily and cross-sections with some chosen reflections as a datum can be prepared easily.

"The time-consuming operation of picking the reflection times and punching them into cards has been avoided by another research group, who have developed an analog-to-digital converter which senses any selected trough and punches the reflection time automatically. The interpreter indicates on a monitor record the troughs of interest, and then the converter makes the time pick to an accuracy of one millisecond from the corresponding magnetic tape record.

"Still another group has developed the digital computer routines to compute migrated cross-sections from such digital reflection-time data, which are then plotted on a specially-designed geophysical plotter. This instrument plots on a 40 x 40 inch surface at a rate of approximately one point each 1½ seconds. When plotting seismic cross-sections, it plots a reflection as a line segment of suitable length and inclined at a dip angle controlled by the input. Reflection quality is indicated by variation of the line 'weight' and texture. A central symbol is printed at the x, y coordinate point of the reflector. In addition to seismic cross-sections, the plotter is also applicable to mapping problems in which x and y are surface coordinates, and derived or measured parameters may be posted by the digital print.

"Digital computers have made possible a major refinement in the application of synthetic seismograms to problems of seismic interpretation. Commercial services now offer synthetic seismograms obtained by electrical filtering of continuous velocity logs, producing a trace equivalent to single reflection at each interface of a wavelet whose shape can be selected.

"During the last two years, at least three research groups have described digital programs for computing synthetic seismograms from velocity logs including all multiple reflections, leading to a number of significant conclusions. Being able to compute the multiple reflections separately and to compare them with the single-reflection contributions is of considerable value. The effect of multiple reflections on the transmitted pulse can also be obtained, and it was shown that passage through a complex section of layers may change the waveform drastically. This means that a reflection from a single isolated interface at depth may be quite complex, simply because the pulse has traversed the complex overlying beds twice, down to the reflector and back to the surface."

The industry continues to give close attention to methods of displaying as well as interpreting data. Western Geophysical Co., Los Angeles, has superimposed variable amplitude records on variable density records to produce a dual display which is enhanced in clarity by the combination. A special camera was developed for the purpose. Galvanometers instead of glow lamps are used. The camera will produce either variable amplitude or variable density separately as well as in combination.

Details of many of the new tools for the geophysicist are reported on succeeding pages. END

Specially designed trailers and Kenworth trucks are used to carry exploration crews over rough and sandy terrain deep into Saudi Arabia's Rub' al-Khali. Photo Courtesy Arabian American Oil Co.

[2] March 1958, pp. 60-63.

NEW TOOLS FOR THE GEOPHYSICIST

The stratigraph– a new research device

by Edoardo Merlini

A NEW APPARATUS called the Stratigraph[1] was created in 1956 by the author in AGIP Mineraria's research laboratory in Metanopoli (Milan, Italy).

The objective of this new instrument is to furnish supplementary data for the correlation of stratigraphic information recorded in the normal course of seismic surveys.

Basically, this new equipment summarizes and integrates, with respect to time, the energy received by all geophones on the surface spread of the conventional seismic record as it is being recorded. The summation of these results is recorded and filmed on a separate trace of the normal seismogram.

A dynamic exponential expander is used to compensate for the variation of amplitude between the early and late energy arrivals down to a record time limit of four seconds. This is necessary because the recording of the energy received is neither filtered nor controlled by conventional AVC systems normally used in seismic field amplifiers.

Once the attenuation function in a specific zone is established, the expander may be properly regulated so as to control the amplitude of the Stratigraph trace. Two or three test shots taken at the outset of the survey are sufficient to obtain the necessary information to properly adjust the expander for the area under study. Obviously this function can also be properly adjusted for playback operation.

[1]Originally named the "Summarizer."

The apparatus shown in Fig. 1 measures 11 by 8 by 18 inches and weighs 22 pounds. This device can be utilized directly in the field, recording simultaneously with the conventional record, or have a later application in a playback office. The normal record, thanks to the special characteristics of the Stratigraph, does not suffer any alteration.

From the study of the results, it would appear that the data shown on the Stratigram, though less indicative from a geometric point of view, shows the possibility of correlating the energy received from specific strata. The most remarkable use of this new device is in the correlation and interpretation of stratigraphic information.

First of all, in areas with strata dipping less than 5°, profiles show that no noticeable changes occurred in the total response curve. Furthermore, it is noted that a lessening in the amount of the explosive charge reduces the amplitude of the trace without any major alteration of its characteristics. Since the effect of the energy received is statistical, tests were made with magnetic tapes recorded under normal conditions, using a reduced number of channels. In such instances the Stratigrams obtained varied in amplitude as well as in quality. The quality became gradually poorer as the number of channels in use were decreased.

In Fig. 2 is shown a seismic profile recorded simultaneously with the trace of the Stratigraph and the conventional traces. The Stratigraph trace has been inked to make it more evident. Where applicable, the Stratigraph trace results were compared with these of well logs. Fig. 3 shows an example in which (the velocity data being known) the well stratigraphy depths and electric log were converted into time for direct comparison with the "Stratigraph log." This procedure is not entirely correct. Nonetheless we choose to present this example to show another possible use of this apparatus.

Additional experiments are under way in an attempt to obtain a better correlation between well logs and "stratigraph logs," en-

Edoardo Merlini joined AGIP Mineraria, oil exploration subsidiary of the Italian government's ENI Group in 1951, and was placed in charge of the electronic laboratory, geophysical research applications. In 1958 he was placed in charge of the research department of AGIP Mineraria.

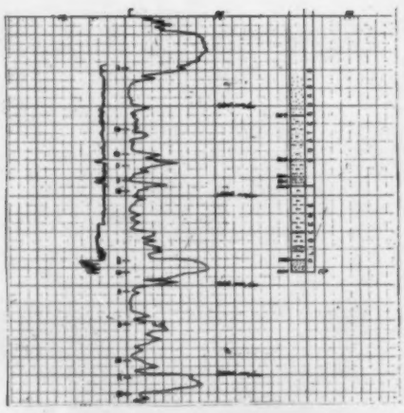


Fig. 3. Well stratigraphy depths and electric logs converted into time for comparison with Stratigrams.

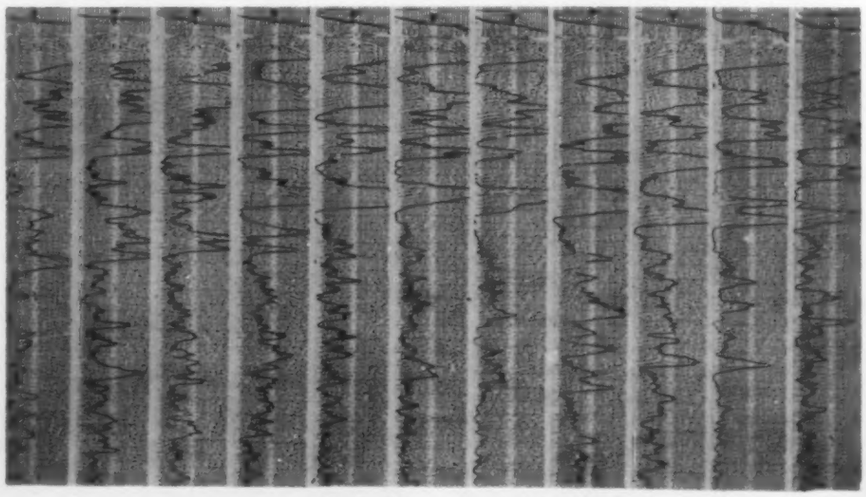


Fig. 2. A stratigram recorded simultaneously with conventional seismic traces. The Stratigraph trace has been inked for clarity.

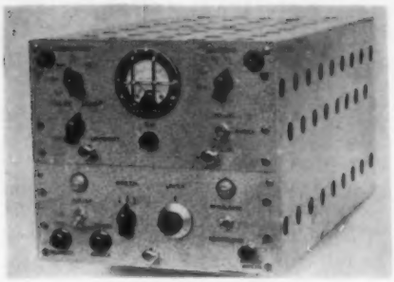


Fig. 1. The Stratigraph instrument measures 11 by 8 by 18 inches and weighs 22 pounds.

listing the aid of a continuous velocity log. These tests are related to the proceeding remarks regarding the results obtained in areas of little dip.

The results obtained so far have been encouraging and new research is now being conducted to improve this instrument to a point of maximum efficiency.

We thankfully acknowledge the cooperation of AGIP Mineraria, a company of the ENI Group, for the permission given to publish the present note.

Special appreciation is also due to Western Geophysical Co. for their collaboration in establishing methods for interpreting the results obtained from the use of this equipment. END

USA and Canadian stratigraph studies

WESTERN GEOPHYSICAL CO., which is the exclusive licensee for Dott. Merlini's process in the United States and most other countries, has been doing a great deal of research on the Stratigraph and now is producing Stratigrams for a number of clients with the understanding that the process is still in the experimental stages.

Dr. Carl H. Savit, director of research for Western, reported on the process to the recent annual meeting of the Society of Exploration Geophysicists. He said that conventional static and dynamic corrections are followed by the integration of a predetermined function of wave energy over the space covered by the seismometer spread and through a short period of record time. The result is a record resembling an electric well log.

Noting that most seismographic exploration has necessarily been devoted to obtaining subsurface *structural* data, Dr. Savit reminded the convention that stratigraphic information has not usually been forthcoming except as stratigraphy could be deduced from structure. Velocity data from refraction surveys or delta-T analyses of reflection results do not satisfactorily reveal important changes in formation character. Such velocity-derived stratigraphic information as these methods provide cannot reveal within miles the point where such changes do occur. The Stratigram section, on the other hand, revealed porosity changes between one shot point and its neighbor.

"Western's technique produces a Stratigram with an unusual amount of 'character' by suppressing noise by summation and integration rather than sharp filtering," he stated. "Amplitude ranges impossible in conventional reflection records are characteristic of the Stratigram. Western's Stratigraph accepts conventional broad-band signals from each seismometer group, regulates signal amplitude by means of a controllable fixed-rate expander, and converts the signal to a function of energy. 'Energy' signals from all groups are then summed and integrated with respect to time."

The Stratigraph will serve in the field, as well as reproduce magnetic tapes in Western's data reduction centers. Investigations are being made by Western to determine the effects of moveout, irregular weathering patterns, spread dimensions and other field conditions on the output. Application of the Stratigraph to very poor or "NR" record areas to learn whether this new function of seismic energy may produce useful information is also scheduled by Western.

Through the courtesy of *Geophysics* magazine, WORLD PETROLEUM is permitted to reproduce Figures A, B and C which were developed in an experimental application of the process in Canada. The illustrations show how the Stratigraph will reveal changes in the porosity of a formation. END

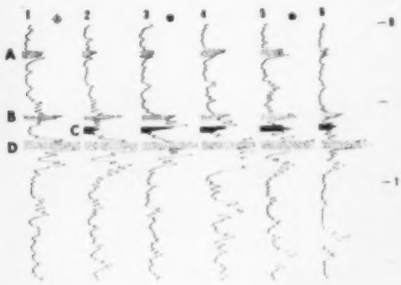


Fig. A—A line of seismic data through a stratigraphic oil field in Western Canada was reproduced by Western Geophysical Co. as a Stratigram. Dark dots between locations 3 and 4 and between 5 and 6 are producing wells. Circle between 1 and 2 is a dry hole. Relatively high energy characterized the Stratigram traces at "C," the level of the producing sand within the field. At location 1, near the dry hole, the energy disappears. (Illustrations courtesy of GEOPHYSICS).

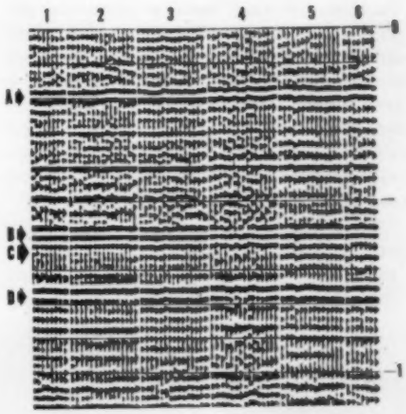


Fig. B—Filtered record section showing reflections in zone of interest (C), corresponding to the energy found on the Stratigram. A, B and D are marked to assist in relating the filtered section and Stratigram. Reflections at C are neither continuous nor, in most cases, pickable. No apparent correlation exists between the behavior of the Stratigram traces at the target level and that of the filtered reflections. Times are measured from an arbitrary datum line.

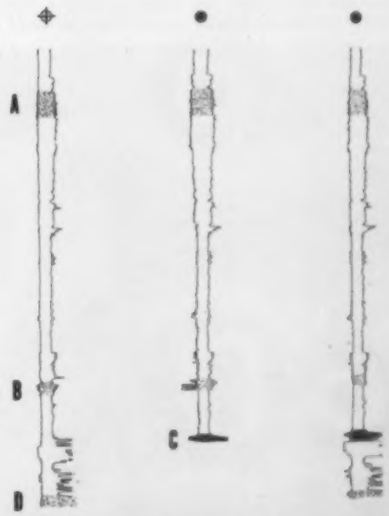


Fig. C—Electric logs from the wells in Fig. A. Horizon C is a porous sandstone at the two producing wells. At the dry hole it is a sandy limestone.

New system cuts marine seismic costs 80% to 90%

FIELD RESEARCH LABORATORIES of Socony Mobil Oil Co. have developed a new marine seismic system for continuous profiling. Unlike Socony's earlier Sonoprobe the new system records good reflections in some areas from 8,000 ft. depths and gives consistent results at 4,000 to 5,000 ft.

Energy for the system is provided by underwater explosions of propane and oxygen or propane and air detonated by an electric spark. By using explosives which may be fed to the gun under controlled conditions it is possible to create shock waves at 3-second intervals so that there is a distance of 18 ft. between shots if boat speed is held at a constant 4 mph.

Signals are picked up by a 150-ft. detector cable towed behind the boat and are amplified in a conventional manner. A magnetic drum compositor permits the addition of signals from successive shots. The record is produced in variable density form on a chart recorder.

Socony Mobil stresses the fact that the new system permits surveying at costs only 10 to 20% as great as those incurred in conventional marine seismic work.

The detonation gun consists of a 20-ft. long metal tube with a fuel mixing chamber and spark plug at the upper end. Diameter of the tube may range from 2-8 in. The lower end is open to the water. The gun is suspended over the side of the boat with the open end about 3 ft. below the surface.

Propane is stored in liquid form on the boat in a standard bottle gas drum. The propane feed line passes through a heat exchanger and is vaporized as pressure is reduced to 20 psi. The boat is equipped with an air compressor and 90 psi pressure storage tank. When air is being used for creating an explosive mixture it is passed through the heat exchanger and the pressure is reduced to 30 psi before being injected with the propane to the mixing chamber of the gun. Liquid oxygen is stored on the boat for use when it is desired to have a somewhat stronger explosion than that created by a propane-air mixture. Its pressure also is reduced to 30 psi before mixing.

When the fuel mixture is ignited by the spark plug a shock wave is created by the burning front which passes downward through the gun at an accelerated rate until it strikes the surface of the water with a force similar to that exerted by a charge of dynamite. Fuel is fed continuously to the gun so that an unburned charge is in place and ready for detonation when the desired time has elapsed.

The detector cable is towed behind the boat. It is kept at the desired depth by a sinker which pulls against a float riding at the surface. The sinker and float are connected with a chain of adjustable length.

The cable consists of two 150 ft. sections. The first is a dummy and the second contains 20 crystals spaced 7.5 ft. apart. A rope trailer extends behind the cable. The dummy portion of the cable is inserted to eliminate the effect of float and sinker turbulence caused by the float and sinker positioning elements. Signals from the cable are similar to those from a single seismic trace.

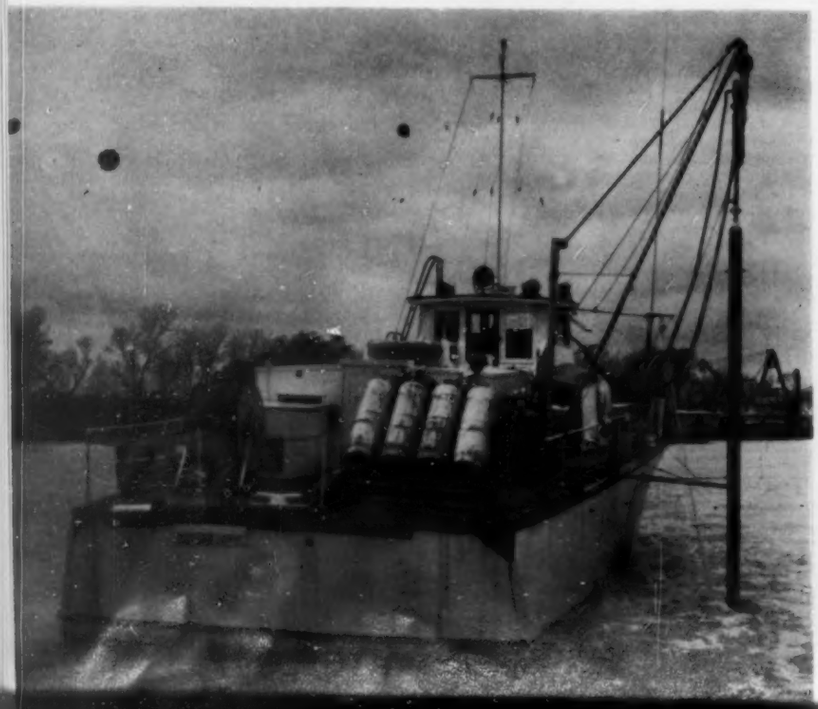
Since deepest possible penetration is desired Socony Mobil composits signals from a number of shots. It has been found that signals from 5 to 10 shots may be composited without exceeding normal seismic ground coverage. The magnetic drum now employed is capable of compositing signals from 2 to 16 shots. There are 8 playback heads on the drum and a track on which the sum of 8 shots may be stored and added later to another 8 for a 16-shot composite.

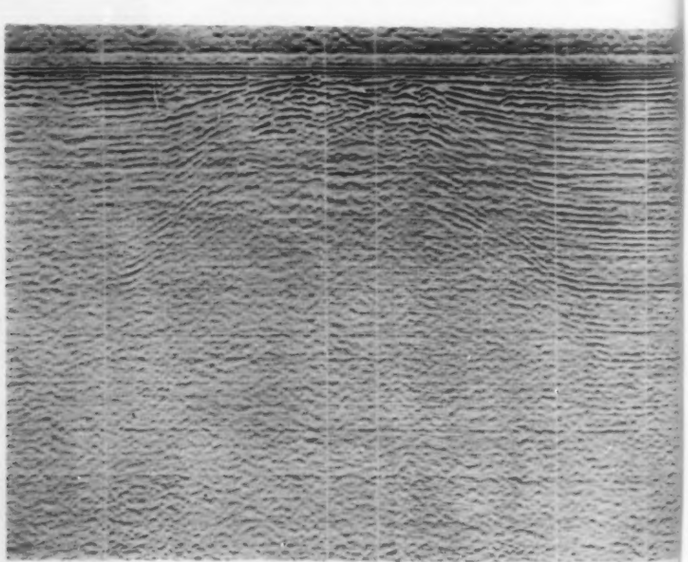
The chart recorder uses 18-inch-wide electrosensitive paper to produce a variable density record. The drum is so operated that it makes a complete revolution every three seconds. With shots being made at 3-second intervals each trace becomes a variable density line across the 18-inch width of the paper.

Mechanical means are supplied for accurate synchronization of the spark in the gun and the recorder.

The system is to be offered to the industry commercially but licensing arrangements have not yet been announced. END

Socony's "Quest" equipped with new seismic system. Propane gun is at right, fuel supply in LPGas bottles and reel for paying out detector cable are on rear deck.





Seismic section recorded offshore from Louisiana.

Airborne gravity meter tested

Rapid gravity measuring from the air may soon open a new era in geophysical exploration when the airborne gravity meter joins the flying magnetometer as a speedy, lowcost reconnaissance tool.

SCIENTISTS have long realized the value of measuring gravity variations from the air. Such a method would enable geophysicists to make gravity surveys over large areas of the earth's surface in a matter of hours—surveys that would require weeks, months, perhaps years of painstaking work if the same data were obtained from ground observation stations. Besides the use of gravity measurements in geophysical prospecting, accurate gravity information is quite important in firing ballistic missiles and in extremely precise surveying and navigation. But to be useful in accurate aiming of long range missiles, for example, the information should be observed on a world-wide scale. The use of aircraft in making gravity measurements would make world wide gravity surveys an imminent probability, instead of a doubtful possibility many years away.

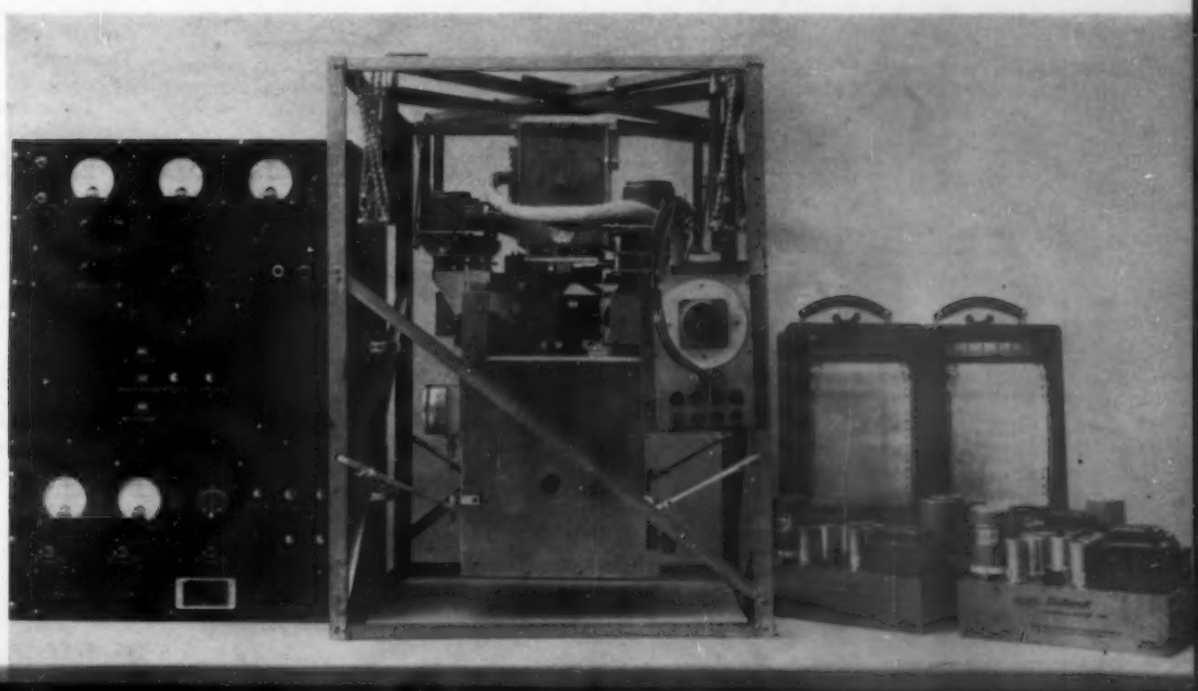
The problems involved in aerial gravity measurements, however, have been so great that such a technique had been considered a practical impossibility until a few months ago. The main obstacle has been the fact that the gravity variations to be measured are minute compared to acceleration forces resulting from the airplane's motion. These acceleration forces would affect the gravity meter in the same way as gravity, except that they would be infinitely greater than gravity.

The successful use of the LaCoste and Romberg airborne gravity meter over a test area was confirmed in a recent paper presented to the Society of Exploration Geophysicists by Dr. L. L. Nettleton of Gravity Meter Exploration Co., Dr. Lucien LaCoste of LaCoste & Romberg and Dr. J. C. Harrison of U.C.L.A. The paper was published in the February issue of *Geophysics* magazine. It provided evidence that gravity measurements can be made from an aircraft to an accuracy of about 10 mg or better, and that reliable gravity contour maps can be constructed from such data. Actually, laboratory tests of the LaCoste and Romberg air-sea gravity meter, using test equipment that simulates air or sea gravity meter, using test equipment that simulates air or sea motions, show that the instrument accuracy is better than ± 1 mg. In actual use, errors larger than this are evidently the result of navigation limitations.

Although the Imperial Valley test was the first complete gravity survey from a commercially equipped airplane, the achievement was preceded by experimental work on submarines and surface ships as far back as 1923. By 1958, submarine and surface ship meters were being operated with accuracies within range of ± 3-5 mg.

The idea of developing an airborne meter was suggested to Dr. LaCoste in October 1958 by Dr. Lloyd Thompson of the Cambridge Air Force Research Center. Dr. Thompson wanted to test the LaCoste and Romberg surface ship meter on an Air Force K135 jet airplane. Although Dr. LaCoste expressed his belief that the navigation would be hopelessly inadequate, Dr. Thompson insisted that he had reason to believe otherwise and a test was arranged. The test was made November 6 and 7, 1958 over the Mojave Desert in California. Results were much better than anyone anticipated. The gravity meter performed perfectly and the navigation was sufficiently good to give gravity values accurate to about 10 mg. Dr. Thompson and Dr. LaCoste operated the meter in the airplanes.

Encouraged by results of the Air Force test, several organizations became interested in the possibility of obtaining sufficient data from the air to construct an accurate gravity map, this time using commercially available aircraft and equipment. The Imperial



LaCoste and Romberg Air-Sea Gravity Meter.

Valley survey on May 12, 1959 was the result of this interest.

In making the test, nine flights were made between 7:35 and 11:50 a.m. During most of the test the aircraft was flown at an altitude of 12,500 ft. Observations were satisfactory over 85% of the 490 miles of flight course.

The B-17 aircraft used for the test was equipped with a six-inch aerial mapping camera, a 35 mm areial spotting camera, and APR precision radar altimeter with a hypsometer for measuring small changes in elevation. The gavity meter was a LaCoste and Romberg surface ship meter modified to incorporate special techniques required for airborne gravity measurement.

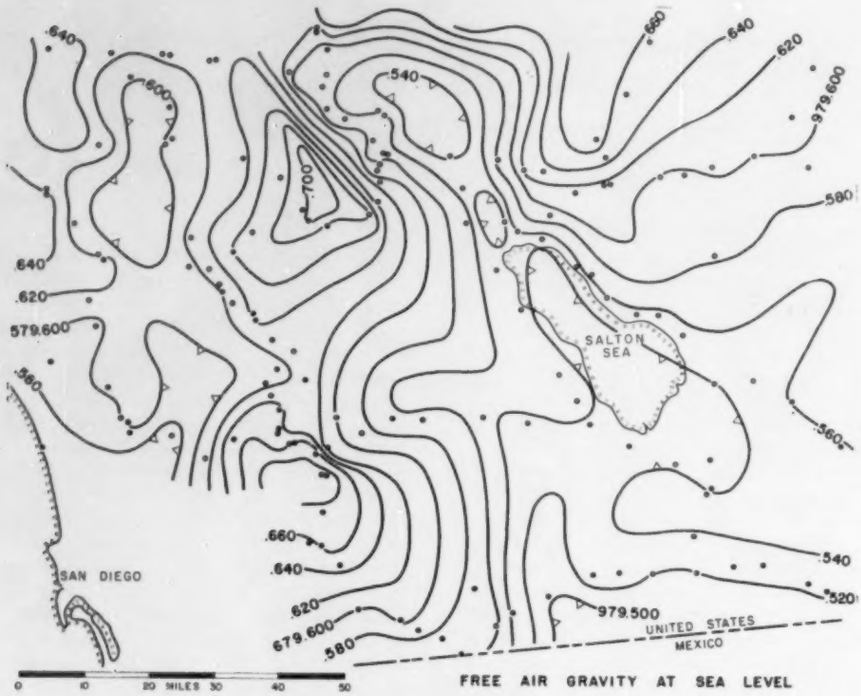


Fig. 2. Free Air Gravity at sea level from surface gravity observations (original data courtesy Prof. George P. Woollard, University of Wisconsin).

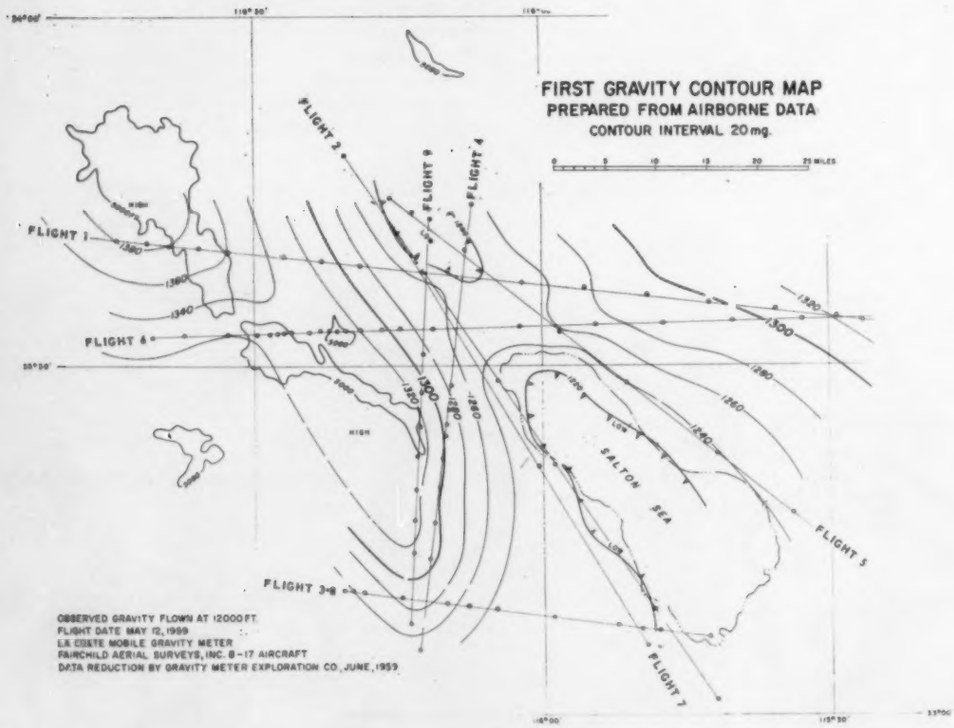


Fig. 1

To use the surface ship meter on an airplane, it was essential to modify it so that readings could be made more rapidly. When using the zero length spring gravity meter normally, readings are taken when the meter and its spring and beam element are at rest. Such a technique is not possible on a fast moving aircraft. The readings must be made while the meter and its gravity sensing element are in motion. This motion introduces acceleration forces resulting in a deflection of the gravity meter beam. Corrections for these acceleration forces and for the beam motion were made automatically into the meter.

Besides modifying the meter to increase its reading speed, corrections for aircraft accelerations had to be computed for each observation. To determine vertical accelerations, the hypsometer was used. This is a very accurate pressure altimeter which measures pressure by determining the boiling point of a liquid. It can measure two-foot changes in altitude.

Horizontal accelerations were sensed with a pair of perpendicular balanced horizontal inertial bars. When the meter was used on a surface ship, an analog computer was used to compute and correct horizontal accelerations. This computer could not be used on the aircraft, however, because the periods of acceleration were longer than those for which the computer was designed. Instead, horizontal accelerations were recorded, and corrections calculated later.

Probably the most troublesome problem in both the Mojave Desert tests and the Imperial Valley Survey was correcting for the Eötvös effect. This effect is the modification of the normal centrifugal acceleration due to rotation of the earth when gravity measurements are made from a moving platform. It was first pointed out by Baron Eötvös in connection with reduction of gravity measurements made at sea. In an airplane, the Eötvös effect becomes much larger and the correction can be calculated sufficiently well only if both speed and direction of the airplane's motion are quite accurately known. This imposes very stringent requirements on the navigation of the airplane.

The normal centrifugal acceleration is proportional to the square of the speed of rotation of the earth. When the airplane is flying east or west, the change in apparent velocity causes a corresponding change in outward acceleration. This acceleration is increased for easterly motion, decreased for westerly motion.

In planning the Imperial Valley survey, test lines were laid out with a number of intersections. Accuracy of the various corrections could then be checked by comparing the corrected values of observations made at these points of intersection. For example, at the intersection of line 6 and line 5, the Eötvös corrections varied almost

Schlumberger

Combination Logging

saves you

time and

money

- *Requires less rig time*
- *Eliminates hazards of multiple runs*
- *Gives complete logs on a single film—immediate interpretation in the field—no tracing or splicing*

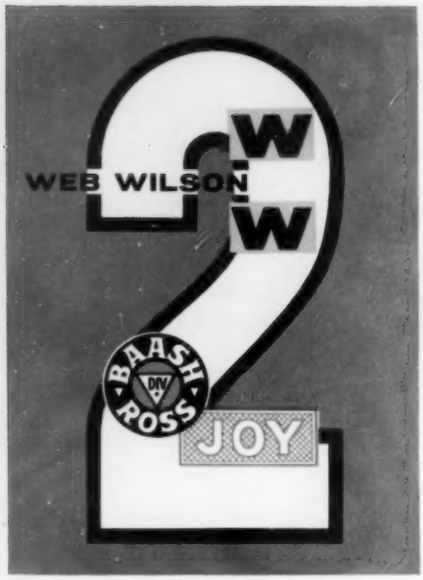
Combining different logging systems into a single, reliable downhole tool is no easy task. It requires extensive engineering to solve the special design problems. It requires greatly increased investment in more complex equipment. *The goal is worth the effort.* Schlumberger research and engineering which brings you improved logging methods now accomplishes a second great objective—faster, safer, more economical operation in Schlumberger Combination Logging.

Call your Schlumberger engineer. He is capable and qualified to help you plan and carry out the logging program needed for best results in your next well.

THESE SCHLUMBERGER COMBINATION LOGS ARE IN THE FIELD:

Induction-Electrical Log • MicroLog-Caliper • Microlaterolog-Caliper
Gamma Ray-Neutron • Gamma Ray-Laterolog • Sonic-Gamma Ray Log
Gamma Ray-Collar Locator — There are more to come.

SCHLUMBERGER



Great Lines Become 1 Better

Web Wilson Now A Part of The Baash-Ross Division of Joy Manufacturing Company

Joined with the well known line of Baash-Ross products is the Web Wilson line of hooks, elevators and links, tongs, and other products, for one better line of equipment to serve the drilling industry.

With even better service, quicker delivery, and one manufacturer responsibility, customers using Baash-Ross—Web Wilson products will realize more fully the advantages of this equipment.

Specify with confidence Baash-Ross—Web Wilson Tools . . . your assurance of quality and continuing service.

ENTERING OUR 41ST YEAR OF PROGRESS

BAASH ROSS JOY

EXTENSIVE RENTAL AND SERVICE FACILITIES ARE AVAILABLE IN MOST OIL FIELD AREAS . . . CALL US.

BAASH-ROSS DIVISION
OF JOY MANUFACTURING COMPANY
General Offices: Houston, Texas

TABLE 1

An example of the principal data involved in the gravity values observed in test flight and their corrections.

Lines	Elevation above sea level (ft)	Speed (mph)	Heading	Observed Gravity (mg)*	Eotvos Correction (mg)	Elev. Corr. to 12,000 ft	Gravity (gals)+	Diff. (mg)
1	12,358	216	276.2°	2249	—1026	+34	978.449	+10
2	12,393	194	144.5	487	+ 723	+37	.439	
1	12,366	216	5.9°	2235	—1025	+34	.436	—2
5	12,411	198	127.7	231	+ 976	+39	.438	
6	12,412	217	358.8°	2231	—1024	+39	.438	+6
2	12,392	192	145.0	488	+ 716	+36	.432	
6	12,415	217	359.4°	2235	—1021	+39	.445	0
5	12,412	198	127.8	241	+ 973	+39	.445	
6	12,412	217	358.8°	2248	—1029	+39	.450	+13
7	12,363	194	147.8	530	+ 681	+34	.437	

* On an arbitrary datum.

\+ On Potsdam datum through ground station at Burbank airport.

Left to right: General E. M. Day, president of Fairchild Aerial Surveys; Dr. Lucien LaCoste of LaCoste and Romberg; Dr. L. L. Nettleton, vice president of Gravity Meter Exploration Co.

2,000 mg. After corrections were applied, however, gravity values observed at this point on the two different flights were identical. At all of the intersecting points, corrected gravity values were generally within 10 mg of each other. (See Table I)

As a further check on the accuracy of the airborne observations, gravity values determined from the observed data were compared with values determined from a number of ground observations along the usable flight lines. This was done by subtracting from each ground station value the free air effect for the difference in elevation between the ground station and the height of the airborne observation. An "attenuation correction" was also applied to each ground station value to account for the smoothing of the anomaly pattern at the airplane's altitude due to the increased distance from the masses causing the gravity variations.

To prepare the gravity map of the area, observations were made at frequent intervals along each of the test lines. To plot the corrected observations, it was necessary to determine the exact location of each point. This was accomplished by the use of simultaneous index marks which were controlled by the six-inch mapping camera. In this way, corresponding fiducial marks were registered on all records each time a picture was taken. The camera also recorded a clock face with sweep second hand and a serial number so that for each picture a fiducial number and time were recorded. Individual records could then correlated with each other and with ground positions determined from the photographs.

After plotting on a map of the area the observed gravity value for each observation point, it was possible to construct a gravity contour map (Figure 1). The general pattern of the gravity field indicated by this map is quite similar to a free air gravity map made from ground readings (Figure 2). The map constructed from ground readings covers a somewhat broader area that includes all of the area mapped from airborne data. Dr. G. P. Woollard of the University of Wisconsin furnished the ground station data for this map.

Results of the test clearly indicated that gravity can be measured from the air, with currently available commercial equipment, to an accuracy of about 10 mg or better. The test also showed that reliable gravity contour maps can be constructed from the airborne observations. These results are quite adequate for geodetic purposes, which require average gravity over relatively large areas. An airborne survey could not, of course, provide as much detail as a ground survey because of the attenuation of local features at the heights required for airborne observations. Such a survey would be useful, however, for broad reconnaissance where large features related to regional structures are present. In presenting their paper to the S.E.G., Dr. Nettleton and his associates expressed the opinion that an airborne survey would develop the large anomalies of the Central Basin Platform in West Texas and New Mexico, or the buried Amarillo Mountains and Anadarko Basin of Oklahoma and the Texas Panhandle.

Although the accuracies indicated by these first experiments with airborne gravity meters are not sufficient for most oil exploration work, a number of ways to improve the procedure are now being studied. So encouraging are the possibilities of making commercial airborne gravity surveys that a private firm, Fairchild LaCoste Gravity Surveys, Inc., has been formed to provide such a service. This firm is jointly owned by Fairchild Aerial Surveys, LaCoste and Romberg, and Gravity Meter Exploration Co. Officials of the new firm are confident that greater accuracy of airborne data may result from any of several possibilities for improvement:

1. Better navigation is available than has been used. So far no Shoran or Hiran navigational systems have been used and these systems are belived to be more accurate than the systems which have been used. Also it may be possible that inertial navigation systems will improve accuracies when they are available to industry.

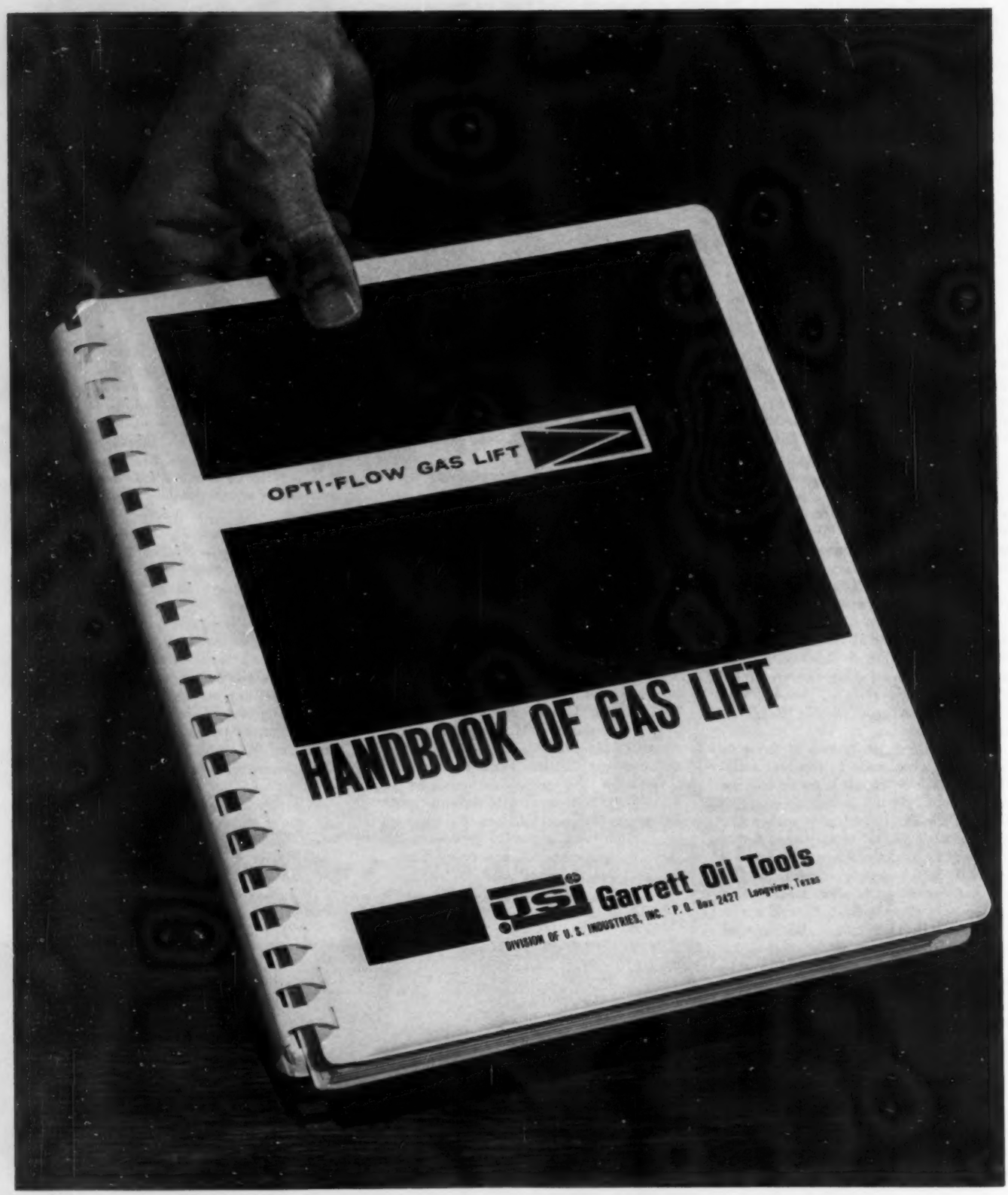
2. Improvements in airplane automatic pilots could improve the accuracy by making the airplane fly a straighter course.

3. It may be possible to fly at lower altitudes and at slower speeds at night, because of smoother air, in order to get better detail.

4. If readings can be made in a helicopter, the errors can be reduced by taking longer readings at each point. The longer readings give more time to average out air disturbances.

END

This converted B-17 carried the LaCoste and Romberg Air-Sea gravity meter used to prepared the first gravity contour map from aerial observations.



For your copy of the Handbook of Gas Lift, please contact your nearest Garrett sales engineer.

Garrett Oil Tools

A DIVISION OF U. S. INDUSTRIES, INC.

PRESENTS

A COMPLETELY NEW CONCEPT OF GAS LIFT INSTALLATION DESIGN

From this Handbook of Gas Lift, these electronically computed master curves enable you to design your continuous lift wells for:

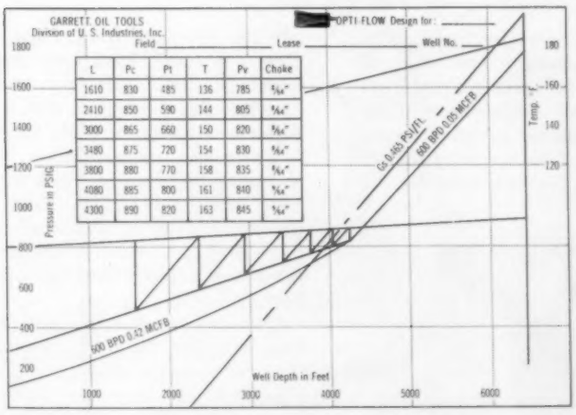
optimum flow with minimum compressor horsepower

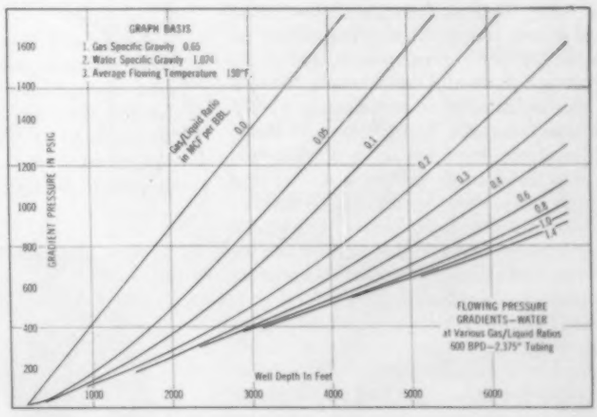
. . . or increased production with existing operating pressures

. . . or production at present flow rate with less compressor horsepower

. . . or production of additional wells with present compressor horsepower.

(Below) Advantages obtainable through the use of the Garrett *Opti-flow* technique are demonstrated by this gas lift design. (At right) The master curves used in solving this particular gas lift problem.



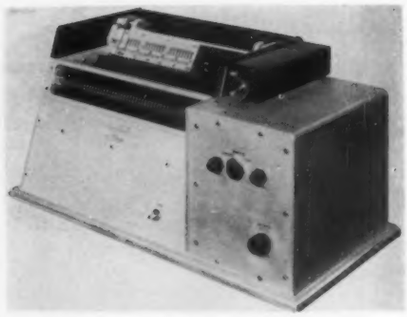


USI Garrett Oil Tools

Division of U. S. Industries, Inc. P. O. Box 2427, Longview, Texas

The "Decatrack"

by J. M. Cunningham[1] and R. E. Norris[2]



A 24 channel Decatrack assembly mounted on a TI-401 Recorder Reproducer.

COMPOSITING is used in seismic exploration to increase the signal-to-noise ratio in difficult areas. This process, sometimes called stacking or integrating, consists of producing several field records in such a manner that when the magnetic recordings are combined or added the wanted information is enhanced and all other information is suppressed. Theoreticaliy the improvement is signal-to-noise ratio provided by compositing is proportional to the square root of the number of samples taken when the wanted signal is in phase and the noise is random.

Various shooting techniques have been described for gathering the field data. One method calls for the successive firing of several charges at different hole depths. The magnetic recordings of each shot are then composited with the necessary corrections made for the difference in travel time.

The magnetic recording equipment required for compositing has usually included a multiple drum recorder, a group of magnetic heads for each drum section with some method for time aligning the sections, and the transcribing electronics. Much of the compositing equipment now in use has been custom designed and has been quite expensive.

In 1959 Techno Instrument Co. introduced a new magnetic recording device for compositing. This development, called the "Decatrack Lateral Displacement Recorder," can be installed on any Techno TI-401 type tape transport. The photograph shows the Decatrack mounted on a TI-401 that has been designed to operate as a slave unit remotely controlled by the tape playback machine in a processing center. The device is much more compact than multi-drum assemblies, and yet it provides for compositing ten magnetic recordings.

The Decatrack assembly consists of a group of special magnetic heads (up to 48) mounted in a movable carrier. The carrier is suspended between the end plates of the TI-401 recorder reproducer on precision linear bearings, which allow it to move laterally along the axis of the drum. Each magnetic head records a track that is .012" wide. Ten such tracks, side by side, with .001" separation can be scanned by a standard .140" wide Techno magnetic head. When scanned in this manner, the output signal produced is the sum of the ten individually recorded tracks. The carrier is moved laterally in ten discrete steps by a detented actuating control and a counter gives a numerical indication of which position is being used.

In a typical operation, the first of ten field recordings is transcribed from the existing playback machine to the Decatrack unit, with the movable carrier set to the first position. When this has been completed, the second field recording is placed on the playback machine and transcribed to the Decatrack with the carrier in the second position. This process is continued until all ten field recordings have been transcribed to the ten Decatrack positions. Then the Decatrack tape is placed on the standard playback unit, and the resulting output is the composite of the ten field tapes. During each transcribing operation all of the data channels are recorded simultaneously.

A natural continuation of this procedure would be to start with one hundred field recordings. After first combining them into ten Decatrack recordings, the process would be repeated to end up with one final recording. (This process has been called "Deca-Decatracking.")

The Decatrack lends itself to many other uses both in the field and in the laboratory. In a truck installation it can be used for compositing the data gathered from weight dropping. Laboratory applications include: the summing of frequency components varying both in frequency and phase in the study of complex wave forms; filtering seismic data using the Decatrack as a multichannel delay line filter with ten sampling points; cross correlating input data against an expected wave form.

Future applications can include any process needing a simple and practical method of compositing multi-channel data. END

[1] Manager. [2] Technical assistant, Techno Instrument Co., Los Angeles.

Nuclear magnetism logging

A new well logging service based on nuclear magnetic resonance is now being offered the industry in California by Byron Jackson Division of Borg-Warner Corp. Service is to be expanded to other areas as equipment is built. The logging tool was developed through a co-operative research program of Borg-Warner and California Research Corp. Field tests conducted in widely scattered areas in the USA indicate that the tool can be used in all known formations except strongly magnetic ones.

BJ nuclear magnetism logging tool which gives a direct indication of fluids in down-hole formations.

The nuclear magnetism log (NML) gives a direct indication of fluids in down-hole rock formations and in many formations provides a permeability index, distinguishes between oil and water zones and indicates saturation in the immediate vicinity of the bore.

Two measurements are made by the tool. One, the free fluid log, provides a continuous formation fluid curve, a correlation curve and provides some information on permeability. The second measurement may distinguish oil and water zones and information on permeability and saturation near the bore. To obtain this measurement the tool is stopped opposite the zone of interest.

The principle of nuclear magnetic resonance employed by the new Byron Jackson logging method may be briefly summarized as follows:

The nuclei of many atoms are similar in

THE DECCA NAVIGATOR COMPANY LTD

Introduce

HI-FIX

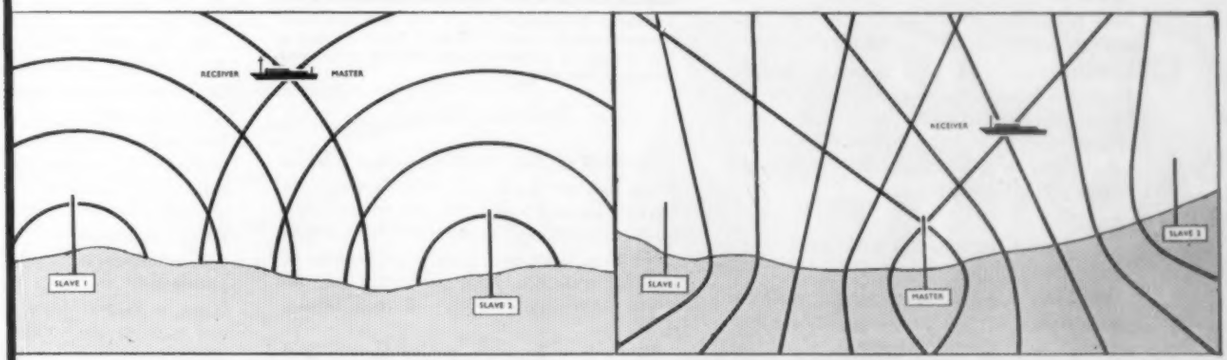
a new offshore survey system operating on high frequencies using very light weight equipment

HI-FIX offers for the first time a system that is:—

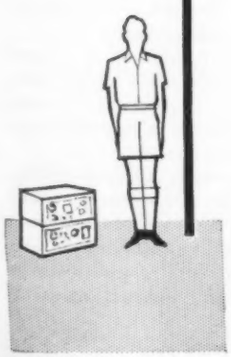
precise, compact, lightweight, highly mobile and suitable for all forms of hydrography, offshore exploration, engineering survey, dredging, etc.

free from the bugbears of 'beat notes', modulated transmissions, multiple frequencies, reference stations, wide bandwidths and interference.

based on the sound principles and employing the same techniques as the Decca Navigator System which is now used in its basic forms by more than 6,000 vessels, to say nothing of the many survey chains throughout the world.



HI-FIX equipment can be deployed in either the TWO RANGE or HYPERBOLIC forms by deploying the master station ashore or on the survey vessel, no equipment changes being required



TWO RANGE HI-FIX

The two-range version gives the maximum accuracy obtainable from the system with only two shore stations and no lattice charts.

HYPERBOLIC HI-FIX

The hyperbolic layout provides a high accuracy service for an unlimited number of users simultaneously.

HI-FIX is the answer for those small inshore areas where Hyperbolic or Two Range Decca is not justified on economic grounds. Normal Decca and HI-FIX stations can be co-sited to give the precision pattern inshore (lane identified by the normal patterns) combined with the long working range of the normal Decca System.

THE DECCA NAVIGATOR COMPANY LIMITED · LONDON · ENGLAND

some respects to submicroscopic bar magnets that are spinning like gyroscopes. When a great many of the nuclei are aligned, they act in unison as a large spinning magnet which "precesses" (wobbles) in a magnetic field. The action is similar to the precession of a toy gyroscope in the earth's gravitational field. At the precession frequency, the atomic nuclei can absorb or radiate electromagnetic waves. This frequency is directly proportional to the strength of the earth's magnetic field.

In operation, the NML tool applies a strong magnetic field to the formation near the well bore. The atomic nuclei in the immediate vicinity tend to change their preferred directions of spin and orient with the stronger field. When this strong field is turned off, the nuclei attempt to align themselves with the earth's much weaker magnetic field. In so doing, they precess in unison to re-orient themselves with the earth's field.

It is during this very short period of time while the nuclei are relaxing back to their original state that they emit tiny electrical signals. These signals are received at the tool, amplified and recorded in the logging truck. The amplitude of the signal determines the amount of fluid within the zone of influence of the system, while the character of the signal indicates the oil or water content.

Fortunately, only hydrogen nuclei give a detectable signal with a nuclear magnetism log. Futhermore, the single protons of the nuclei must be attached to molecules *in a fluid*. These restrictions arise from the combined effects of the spin, magnetic moments and relaxation (or friction) force for the various nuclei found in earth formations.

As a result, the tool responds only to hydrogen-bearing fluids—water and oil—in down-hole formations. Water chemically bound in clays and the fluids in shales and other tight or low-permeability rocks does not give NML signals.

Time Base and DC Amplifier

New Houston Instrument Corp. time base provides seven rates of sweep voltage for use with X-Y plotters. Rates available from 0.5 millivolts per second to 50 millivolts per second with 2% accuracy, which corresponds to 2 seconds to 200 seconds for 100 millivolts. By resetting the recorder attenuator sweep rates may be reduced to 1,000 seconds with some loss in linearity.

Starting and resetting may be accomplished by a panel switch or a single remote contact. A "halt" switch is provided to stop and later resume the sweep at any time.

By rotating the panel selector to "DC Amp" the unit becomes a multi-purpose chopper stabilized DC amplifier. Current or voltage sources deliver either an amplified current or voltage output as desired by use of proper shunts. For example, shunting a 1,000 ohm precision resistor across the output terminals gives a drift free voltage amplifier with a gain of 1,000. It may be used with X-Y recorders as a primary low level preamplifier or with galvanometer 0-1 MA recorders. Used with a standard 10 millivolt per inch recorder, sensitivities up to 10 inches per millivolt are obtainable.

Abem Magnetometer

A B Elektrisk Malmletning, Stockholm, has introduced the MZ-4 magnetometer which has a wide measuring range and high overall accuracy making it possible to use the instrument anywhere in the world. Continuous readings may be made over an interval of about 20,000γ. The super range has 20 built-in steps to give accurate bas transfers and extend the continuous reading interval from +150,000γ to —150,000γ. The sensitive range micrometer drum may be read to about 1γ and an overall field accuracy of about 3γ is obtainable.

Hydraulically induced 10-foot and 30-foot vertical fracture views taken with Birdwell borehole camera. This picture is oriented with compass suspended below the camera sonde.

Borehole Camera

Birdwell division of Seismograph Service Corp. has developed a borehole camera for locating natural and artificially created fractures intersecting boreholes. The method sheds new light on borehole evaluation or regional tectonics, rock properties and internal yield characteristics of rock formations.

Birdwell radioactive tracer surveys and oriented, borehole camera pictures have indicated the presence of many naturally occurring directional fractures and faults. This information can be of considerable use in structural studies and is essential to many production and secondary recovery operations.

Statistical studies of information obtained in surveying hydraulically fractured wells indicate that for the areas of study: (1) the ideal hydraudic fracture treatment is uncommon in that the fractures are seldom created so as to most economically drain the reservoir; (2) more than one-third of all fracture treatments may result in the production of out-of-zone water; (3) a large percentage of induced fractures are vertical and (4) proper well completion and treatment methods can vastly increase fracturing efficiency.

The camera is located at the bottom of a sonde 5 ft long with an outside diameter of 4 inches. The camera lens looks straight down. Also in the bottom of the sonde is the light source, which is actuated electrically from the surface and is synchronized with film movement.

The camera magazine contains enough 16-mm film to take about 600 pictures before reloading. Focal length of the camera is adjustable, but that used in most applications is 6 in. through 3 ft from the end of the sonde.

Keyboard Input Unit

Electrodynamic Instrument Corp. has developed a new method of processing tape recorded seismic data. The basic component of this new method, which is now an integral part of EIC's PB-50/60 Series Playback Systems, is an adding machine-type instrument with a ten-digit keyboard. Designated the Keyboard Input Unit, this instrument enables the sequential insertion of normal moveout, weathering and elevation corrections in one fast, finger tip operation, and provides a paper tape record of the corrections punched in for each seismic channel. Dynamic and static corrections for the succeeding channel can be punched-in while the preceding channel is processed. Consequently, the speed of which a seismic data tape is processed will be limted only by the rotation of the playback system's tape drum(s). The keyboard input unit eliminates the critical setting of multiple dials and controls and the need for a highly skilled operator is eliminated.

In an EIC PB-50/60 Series Playback System with a keyboard input unit, the normal moveout correction for a seismic channel is punched-in as a percentage of the maximum normal moveout value. Static corrections (weathering and elevation) are then punched-in as exact values in milliseconds, together with the appropriate "polarity" character.

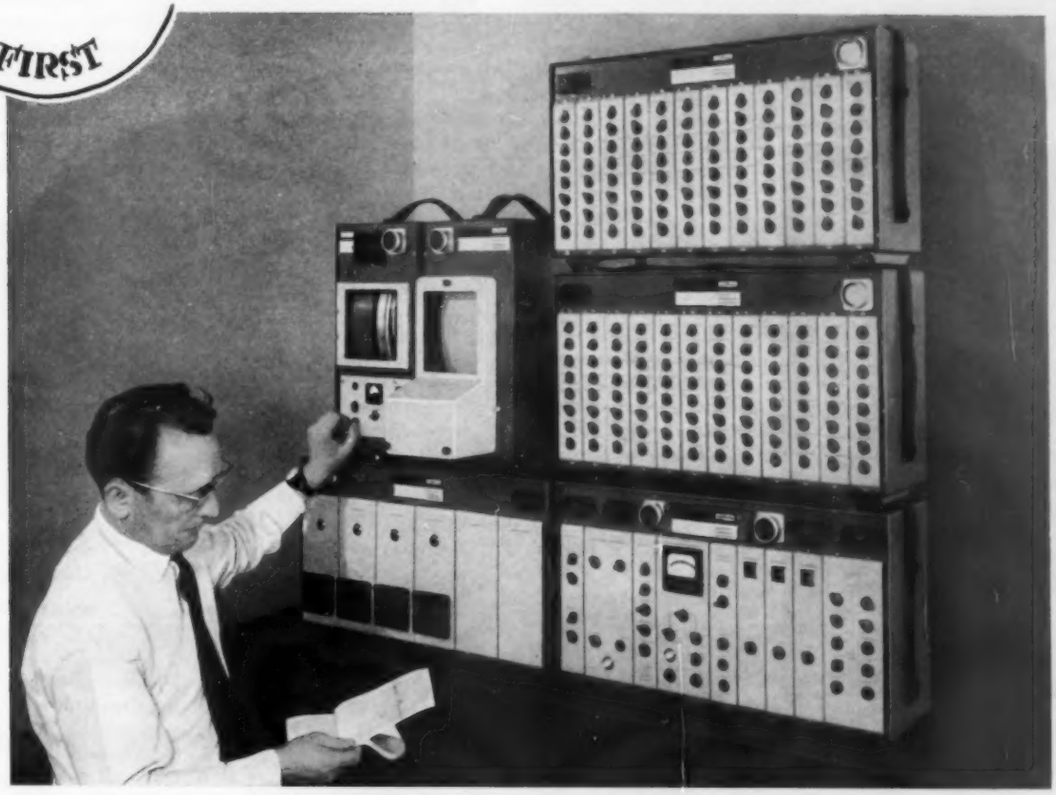
The normal moveout (NMO) corrections punched-in selects a proportional voltage from a tapped autotransformer network, and applies this voltage across the function potentiometer of the PB-50/60 system. The arm of the function potentiometer is mechanically coupled to a cam follower which moves at a velocity determined by the shape of an NMO cam. The polarity character punched-in for static corrections determines the voltage-polarity of another tapped autotransformer network. The punched-in static correction values select a calibrated voltage from this autotransformer.

The resultant velocity-function voltage from the function potentiometer, the static correction voltage, and a servo follow-up voltage are then fed to a 400-cps servo amplifier system. This servo amplifier system references the seismic channel magnetic

FIRST EUROPEAN FIRST

magnetic seismic recorder

ems 11



- 30-track magnetic-tape recording system: 24 seismic plus 6 auxiliary channels
- High sensitivity *(1 microvolt)* and wide response range *(1 to 220 cps)* permit both *reflection* and *refraction* methods of operation
- Features *unique gain control system:*

a) *programmed gain control* of the 24 seismic amplifiers by photographic film scanned by 2 photocells

b) *individual* A.G.C. for each seismic amplifier

- Self-contained portable field outfit conveniently unitized in 6 all-weather sealed carrier cases
- Field monitoring with *track-mixing facilities* (2 or 3 tracks at a time) and *continuously adjustable* weighing control

LE Belin

licence Institut Français du Pétrole

LABORATOIRE INDUSTRIEL D'ELECTRONIQUE BELIN
296, Avenue Napoléon-Bonaparte RUEIL-MALMAISON (S & O) FRANCE
Téléphone : 967-15-54 - Câbles : BELINUSINE-RUEIL

head for static corrections, and then instantaneously drives the magnetic head at the dynamic velocity required for NMO correction. The time-corrected seismic data is then simultaneously re-recorded on magnetic tape and plotted photographically in cross-section form.

Birdwell 14-pen field recorder installed in Birdwell truck.

14-Pen Log Recorder

A 14-pen, dual chart recorder, which cuts the time required for well logging, and can record seven types of well information simultaneously has been introduced by the Birdwell division of Seismograph Service Corp. The recorder has two chart drives allowing for simultaneous dual-recording of well information. The recording pens use a non-clogging chemical in place of ink, eliminating the need for redrafting the original log.

The recorder has four depth scales of 1, 2, 5 and 20 inches per 100 ft, and any two of these may be used at the same time. A time marker, which indicates one minute intervals on the log, is incorporated and is used primarily with Birdwell's nuclear logging services. In addition, the charts may be time driven for presentation of changes in borehole characteristics versus time.

The recorder produces a log that is visible to the operator immediately as it is made. It cuts rig time through its ability to record a combination of logging information. Many wells can be completely logged with one trip into the well.

Buys Empire Logging Division

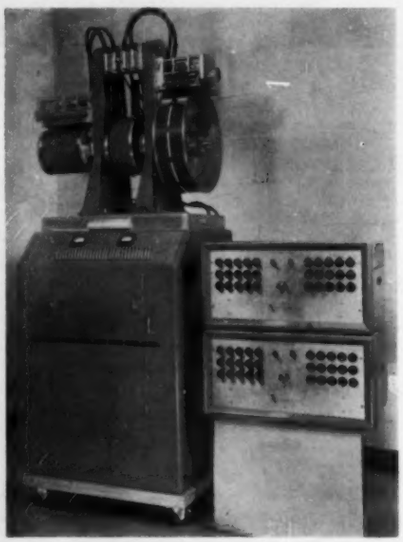
Pan Geo Atlans Corp., has purchased the acoustic logging division of Empire Geophysical, Inc., Fort Worth. PGAC has taken over all equipment, personnel, and branch offices and stations of Empire's Acoustic Logging Division operated from district headquarters at Odessa and Corpus Christi, Texas, and at Jackson, Miss. The logging service will be extended to additional areas as soon as practicable.

Charles H. Thurber, formerly vice president of Empire and general manager of the acoustic logging division, will continue as manager of PGAS's acoustic logging department. R. E. Stewart will continue in charge at Odessa, B. J. Gay at Corpus Christi; and D. M. Muir at Jackson, Miss.

Geograph France Formed

A French company to operate the Geograph in Europe and the French Union has been formed by the Robert H. Ray Geophysical Companies and Compagnie Generale de Geophysique of France. The new company will be known as Geografrance with headquarters in Paris. Charles L. Robinson of Houston will serve as technical director in the Paris office.

At the present time the Geograph, more commonly known as "Thumper," is operated by Robert H. Ray Company, Inc. in the U. S., Canada and Australia; while McCollum Ray International Inc. handles the Thumper in all other countries other than those covered by GEOGRAFRANCE. This new jointly owned subsidiary will operate the Geograph in West Germany, Italy, Holland, Belgium, Luxembourg, France and the French Union.



High speed tape transcriber.

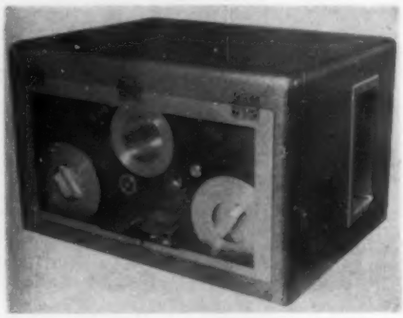
Single Revolution Omnitape

The "single revolution" Omnitape is capable of transcribing tapes 28 times as fast as the standard sequential machine which was introduced in 1957 by Hale Instruments, Inc.

The "single revolution" instrument is equipped with a bank of magnetic heads on each side of the machine. The rate of transcription is limited only by the speed at which the operator can load and unload tapes. Fast and capable operators can transcribe better than 100 tapes per hour.

This Omnitape can be adapted to any of the magnetic tape systems that the sequential machine can transcribe, including Magnedisc. To change the machine from one system to another, changing both head banks and the electronics, takes about 15 minutes.

A patch board is used to orient the traces on the transcribed tape. This leaves the operator free to load and unload tape.



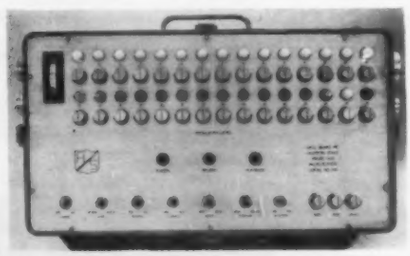
Tape transport for Hall Sears reel recorder.

Reel Recorder

Hall Sears Inc. has developed a reel recorder without frills the designers think unnecessary. It consists of two units, the tape transport and the electronics unit. In the transport a capstan driven by a synchronous motor pulls the tape at a constant speed during recording and playing back. Separate motors are provided for a fast forward drive as well as a fast reverse drive, thus permitting quick location of a particular recording as well as fast rewinding. A fork controlled inverter for driving the synchronous motor is an integral part of the unit. A 12-volt D.C. power source provides complete operation. The dust proof case is provided with conventional access doors for loading and unloading the tape reels and for marking an identification on the individual recordings made on each reel.

One hundred feet of three mil tape can be loaded on a reel. The standard tape speed of 7.5 inches per second and Carter head spacing are used, with holes in the tape prepunched to allow the reel of tape to be cut later into individual tape records that are the same as those obtained from a drum type Carter recorder. Other tape speeds and head spacings are available.

The magnetic recording heads on the tape transport are brought out to plugs. All

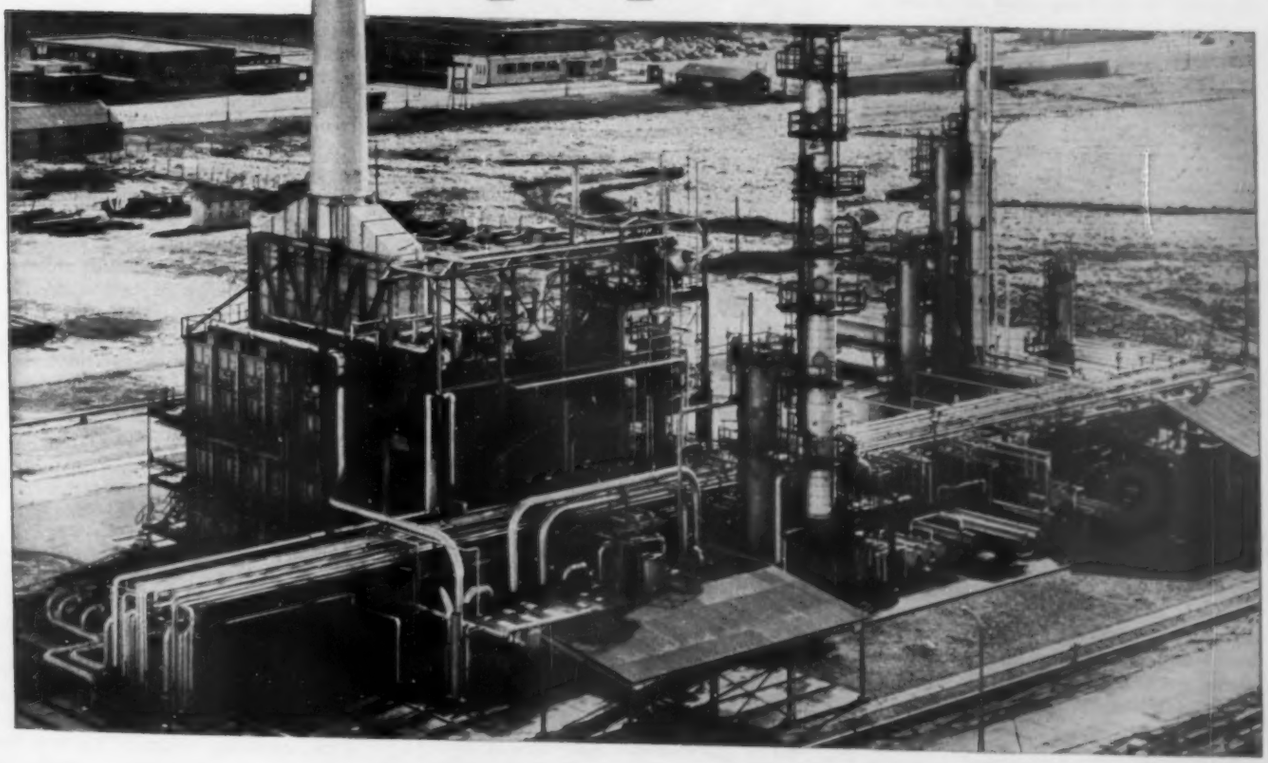


Electronics unit for Hall Sears reel recorder.

catalysts in action

SPENCE

Spence COMOX catalyst is used for desulphurisation in oil refineries throughout the world. COMOX is noted for its long life, high activity, selectivity and robustness under the most severe operating conditions. Spence Product Development Department will gladly provide further information on COMOX and other catalysts which are available in commercial and development quantities.



Mobil Refinery, Coryton. Photograph by courtesy of Mobil Oil Co. Ltd.

PETER SPENCE & SONS LIMITED, WIDNES, LANCS
Also at London, Bristol and Glasgow

electronics except those required to operate the recording heads are integral with the tape transport. Therefore, the transport is suitable for use with any amplifier—modulator system.

The standard modulators and demodulators are housed in a separate unit along with all the switching necessary to go from record to playback and vice-versa. The modulators and demodulators are pulse width type with a basic carrier frequency of 800 cps. Twenty-four channels are provided for the standard seismic traces. In addition, time break, up-hole and timing reference modulators and demodulators are included with sufficient drive to operate a galvanometer directly.

Automatic cycling circuitry provides for stopping and starting of the tape transport at the proper time, and when used with the Model HS-100 Amplifier and Model HS-600 Oscillograph, all interrelated functions such as energizing oscillograph motor, trip and resetting amplifier, relay switching of amplifiers, filters, and firing of blaster are controlled in the proper order.

A step switch is also provided for sequential playback one trace at a time if the individual records are cut and made into a continuous loop. The level of modulation of all traces can be determined by stepping the step switch to each trace and observing the meter on the front panel. A control for each trace is provided to adjust the modulation level.

National 19-L Seismometer.

Seismometer

National Geophysical Co., Inc., has introduced its Type 19-L Seismometer, which combines high sensitivity with ruggedness (no clamping of the suspension is required at any time). The unit is available in any Impedance from a few ohms up to 6,000 ohms. The natural frequency also can be varied from 3 to 10 cycles plus or minus .025 cycles. Case size of the 19-L is 5.5-inches high by 6-inches diameter. Its low profile reduces wind pick-up, and the bottom-of-case location of lead wires further reduces wind noise.

Miniature and Refraction Geophones

A Hall-Sears, Inc.'s new product development during 1959 was the HS-J subminiature geophone which is only one inch in diameter and two ounces in weight. In spite of its remarkable size, the damping characteristics of the HS-J match those of the standard HS-1. The output is .3 volt/inch/second, one-half that of the larger unit.

It is adaptable for permanent connection to portable spread cables or conventional multiple or single leaders. The rugged construction insures long life under severe field usage. Internal construction eliminates coil pigtails and hermetic terminal seals. A dual spring assembly is employed.

The company also introduced the HS-10 refraction geophone which provides high sensitivity down to 2 cps. The geophone does not require a transit lock and may be carried in a normal manner. A new type permanent magnet material was used to reduce weight. Satisfactory operation is maintained with a tilt of up to 10°. Weight in aluminum case is 9 lb. and in brass 13 lb.

Variable mu magnetic variometer.

Variable Mu Magnetic Variometer

Ruska Instrument Corp. is rigorously testing the Variable Mu Magnetic Variometer, an electronic magnetometer which consists of a sensing unit and an indicating unit interconnected with two cables approximately twenty feet long. It contains a system of ferromagnetic cores which are wound with coils. The change in the inductance of the coils, due to the variation in the permeability of the cores, is measured. In operating the instrument the observer sets the sensing unit on the ground, level within approximately five degrees, so that the bubble in the level vial is free. Carrying the indicating unit, he will step approximately 15 ft. away from the sensing unit and turn the dial so that the null device or galvanometer reads zero. After noting his dial readings, he will then pick up his equipment and transport it to the next station. No orienting, leveling, releasing, clamping, or tripod handling is necessary.

Prior to general introduction to the industry Ruska is giving the instrument a thorough shakedown including tests under conditions found in various parts of the world. The tests include determination of operating range, sensitivity range and linearity of sensitivity over wide operating ranges.

Sinclair miniaturized seismograph system for surveying the structure of shallow rock formations hidden by surface sediments.

Shallow Reflection Seismograph

Sinclair Research Laboratories, Inc. of Tulsa has recently developed a 12-channel "suitcase" set of seismic equipment primarily to explore the first two or three thousand feet of the earth. Since the resolution of thin beds necessarily requires high seismic frequencies, this equipment has been adjusted to amplify and display the spectrum above fifty cycles. However, since the equipment is quite versatile, it may also be used for normal seismic exploration.

By utilizing the Sinclair "Seismod"* record display technique with high frequency amplifiers, the attitude of very thin beds in the near surface may be displayed. The complete set of equipment includes seismod amplifier, camera and developer unit with a 12-volt power supply.

The system simultaneously records the seismic information in the "Seismod" mode and in the conventional "wiggle trace" mode on the same photographic record, allowing direct comparison of the two displays. These seismograms may then be split and assembled in record sections for even greater facility of interpretation.

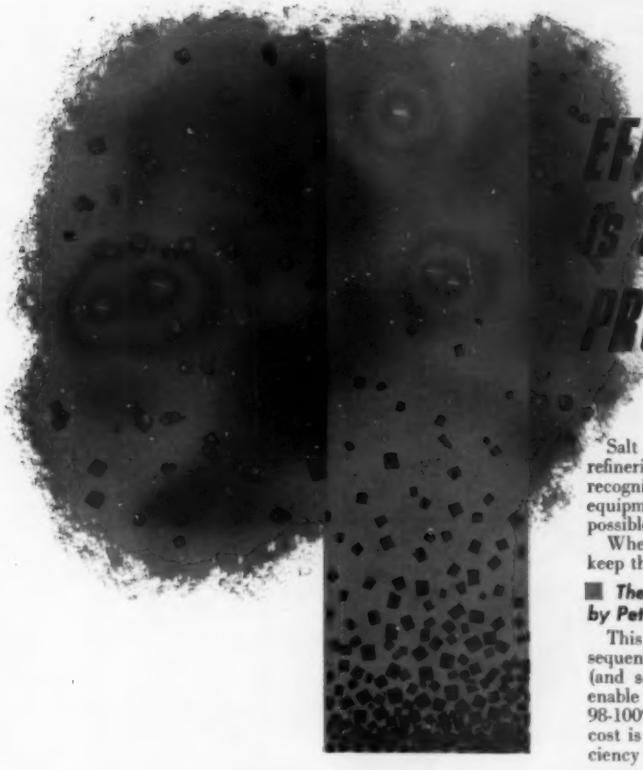
*Manufactured by Electro-Technical Laboratories, Houston, Texas, under license from Sinclair.

New Portable and Office Systems

Southwestern Industrial Electronics Co., a Division of Dresser Industries, Inc., recently introduced a new portable full-spectrum FM magnetic recording system, a portable full-spectrum seismograph amplifier system, and two complete geophysical data processing systems. This new battery of systems provides total instrumentation for every phase of exploration and data analysis.

The SIE PMR-20 Portable FM Magnetic Recording System, a 28-channel all-transis-

(*Continued on page* 70)



EFFICIENT DESALTING is the first step towards PROFITABLE REFINING

Salt removal is now a routine operation in all modern refineries. With the need for effective desalting widely recognized, the main problem today is the selection of that equipment which will do the most efficient job at the least possible cost.

When you need new or additional desalting facilities, keep these points in mind:

■ ***The first electric desalter was designed and installed by Petreco engineers.***

This was nearly a quarter of a century ago. The subsequent years of solid, practical experience in dealing with (and solving) desalting problems all over the world now enable Petreco desalting to yield salt removals in the 98-100% range. The fraction of a cent per barrel desalting cost is saved many times over by the gains in refining efficiency resulting from a clean charging crude.

■ ***The first chemical desalter was designed and developed by Tretolite engineers.***

Tretolite chemical formulations were the first ever to be used in desalting. Tretolite desalting units are the only exclusively chemical desalters ever to be sold and installed in the refining industry and are currently used to desalt a million and a half barrels per day. In fact, every important development in crude oil desalting has resulted from the Petrolite research, engineering and development program.

YOU GET 98-100%

SALT REMOVAL WITH

PETRECO ELECTRIC

OR TRETOLITE

CHEMICAL DESALTING

Because Petreco offers both kinds of desalters, the company has no "axe to grind". This means that you get an honest and objective appraisal of the method best suited to your operation.

There is no other desalting equipment on the market today that can offer you comparable efficiency of design. The operating records from installations around the world *prove* it! There's no other company, either, that can offer you Petreco's fund of desalting technology or Petreco's rich background in this highly specialized field.

PC-60-2ER

PETROLITE CORPORATION

PETROLITE LIMITED
30 Savile Row, London W1, England

TRETOLITE COMPANY DIVISION
Saint Louis 19, Missouri · Los Angeles 22, California

PETRECO DIVISION
Houston 1, Texas

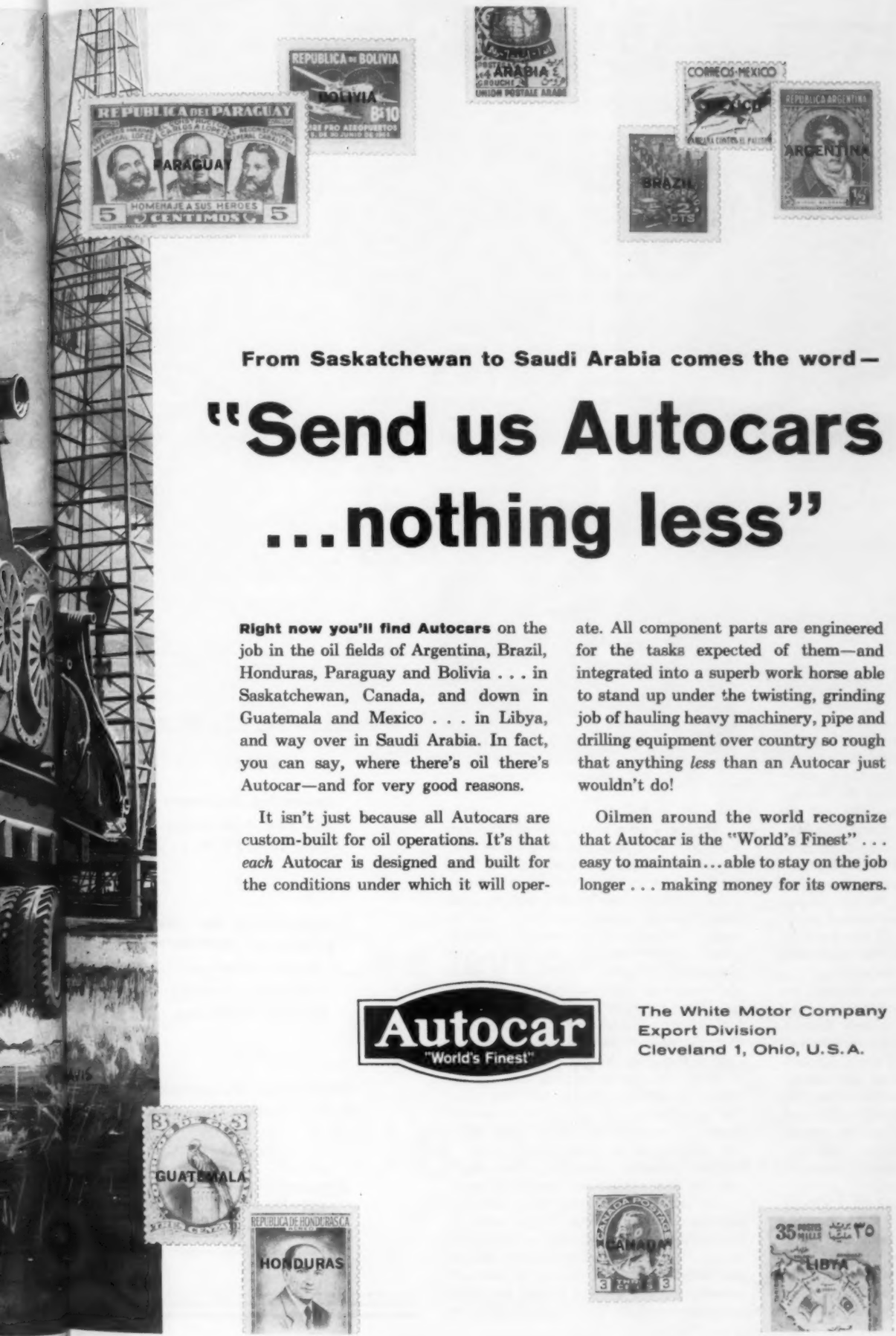
AFFILIATED COMPANIES

CANADA: Petrolite Corporation of Canada, Limited, Edmonton, Alberta
COLOMBIA: South American Petrolite Corporation, Bogota
GERMANY: Petrolite Anlagenbau und Vertriebsgesellschaft, m.b.H., Frankfurt a. M.
VENEZUELA: South American Petrolite Corporation, Caracas

REPRESENTATIVES

ARGENTINA: S. A. ASTAR, Buenos Aires
BRAZIL: WERCO, Ltda., Avenida Rio Branco 57-s/1410-11, Rio de Janeiro
ITALY: NYMCO, S.p.A., 9 Lungotevere A. da Brescia, Rome
JAPAN: Maruwa Bussan KK, No. 3, 2-Chome, Kyobashi, Chuo-Ku, Tokyo
KUWAIT: F. N. Dahdah, Box 1713, Al Kuwait
MEXICO: R. E. Power, Sierra de Mijes No. 125, Mexico, D. F.
NETHERLANDS: F. E. C. Jenkins, Hoefbladlaan 134, The Hague
PERU: Oilfield Import, S. A., Apartado 71, Talara
TRINIDAD: Neal and Massy, Ltd., P.O. Box 544, Port of Spain

NOTHING LESS than the "World's Finest" is wanted by men in the foreign oil fields. Many American companies ship Autocars to countries where oil-field operations are toughest.



From Saskatchewan to Saudi Arabia comes the word—

"Send us Autocars ...nothing less"

Right now you'll find Autocars on the job in the oil fields of Argentina, Brazil, Honduras, Paraguay and Bolivia . . . in Saskatchewan, Canada, and down in Guatemala and Mexico . . . in Libya, and way over in Saudi Arabia. In fact, you can say, where there's oil there's Autocar—and for very good reasons.

It isn't just because all Autocars are custom-built for oil operations. It's that *each* Autocar is designed and built for the conditions under which it will operate. All component parts are engineered for the tasks expected of them—and integrated into a superb work horse able to stand up under the twisting, grinding job of hauling heavy machinery, pipe and drilling equipment over country so rough that anything *less* than an Autocar just wouldn't do!

Oilmen around the world recognize that Autocar is the "World's Finest" . . . easy to maintain . . . able to stay on the job longer . . . making money for its owners.

Autocar
"World's Finest"

The White Motor Company
Export Division
Cleveland 1, Ohio, U.S.A.

Two unit 107-lb portable SIE recorder and master unit.

torized record-playback system is complete in two compact, lightweight units and offers full-spectrum recording for reflection, refraction, and high frequency signals. It provides high-fidelity, frequency modulated recordings of seismic data on standard SIE magnetic tapes from the output of standard geophysical amplifiers.

The unit is equipped with a newly developed all-transistor circuitry for low power drain, (less than 1/10 of vacuum tube models) and provides low noise level, low distortion, and precise timing accuracy.

The system's two aluminum-cased, watertight units weighing a total of 107 lbs., are designated the MR-20 Recorder and the MU-20 Master Unit, respectively. The MR-20 houses the recording drum, drum drive system and recording head banks. Modulators, demodulators, switching and auxiliary electronics are contained in the Master Unit, in addition to a transistorized power supply which converts the 12 vdc from the external power source to the regulated levels required in all parts of the system.

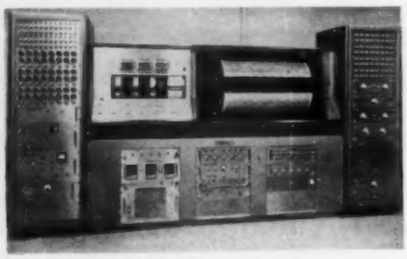
Added to 24 seismic data channels are time-break, up-hole, noise-cancelling and 100 cps timing reference channels. Recording and playback modulation levels are read directly from the front panel meter. Record-playback switching functions are accomplished from a single front-panel switch. Provision is made for playing back tapes through the seismic amplifier or directly through the output transformer of the seismic amplifier. FM magnetic recording is used in the recording system.

For use in conjunction with the PMR-20, or independently, is SIE's P-33 Portable Seismograph System, the individual 50-lb units of which can be carried on a back pack in difficult terrain. The system offers a full spectrum for reflection, refraction or high frequency recording, with only a few moments required for switching. The full-spectrum amplifiers are housed in four cases of six amplifiers each. All normal operating controls are contained in one unit. A power supply and oscillograph complete the system.

New amplifier circuitry and control-unit design permits fast and accurate matching and pre-recording adjustments. Control knobs and switches are "convenience grouped," and a wide variety of control factors are easily selected. Units are cased in hermetically sealed aluminum.

Completing SIE's program of total instrumentation from field recording to data processing and analysis are the MS-21 and MS-31 GeoData Systems, which have provisions for making full size photographic cross-sections with various types of presentations. The MS-21 has two magnetic drums, a monitoring drum, and a photographic drum, and is used primarily for producing filtered and time-corrected cross-sections. Provisions are also incorporated for trace mixing.

The MS-31 has three magnetic drums and includes all of the features of the MS-21 plus compositing techniques for improving the quality of seismic records.



SIE MS-31 GeoData processing system.

These new units are capable of processing both SIE AM and FM field tapes. Corrected field tapes and conventional "wiggle," variable density or variable area photographic records can be obtained. In addition, variable density recordings may be made superimposed on standard "wiggle" trace cross-sections. Also, an electric stylus pen-written 24-trace record can be made simultaneously for monitoring purposes, etc. Time corrections (NMO), weathering and elevation are inserted at the same time that the cross-section is made so that no time is lost in making a corrected record.

These time cross sections can be isopached or set to a desired reference plane for presentation in geologically oriented form. The new GeoData units can preserve the information on these final records on magnetic tape for future use, or can duplicate the final records any number of times.

The final records incorporate weathering and elevation corrections, normal moveout corrections, and spread configuration information. No mechanical operations, such as the interchanging or recutting of cams, are necessary. All correction factors are generated electroncially. The system handles any spread configuration, including offsets.

Any horizontal scale can be used for cross-sections. A true horizontal scale can be presented even though spread lengths vary throughout the cross-section. Traces may be skipped as desired without leaving blank trace positions on the photographed record. Trial schemes of filtering and record mixing can be observed on an oscillographic drum before the final paper records are made.

Various weathering and elevation corrections, as well as normal moveout analysis recordings and curves can be displayed to determine optimum normal moveout corrections.

The photographic presentation can be monitored from the front panel during operation. This may be done in a lighted room without exposure to the photographic film. The photographic drum uses 42" wide photographic film or paper and has a surface speed of 12" per second. A front panel control adjusts trace spacing to provide 13 to 20 (24-trace) records per cross-section.

Delay systems can be provided which have a NMO correction range of 150 ms, or optionally, a range of 390 ms where larger Δt corrections are required. The 390 ms range delay line system includes special electronic circuitry to compensate for errors when using proportional NMO for large values of Δt.

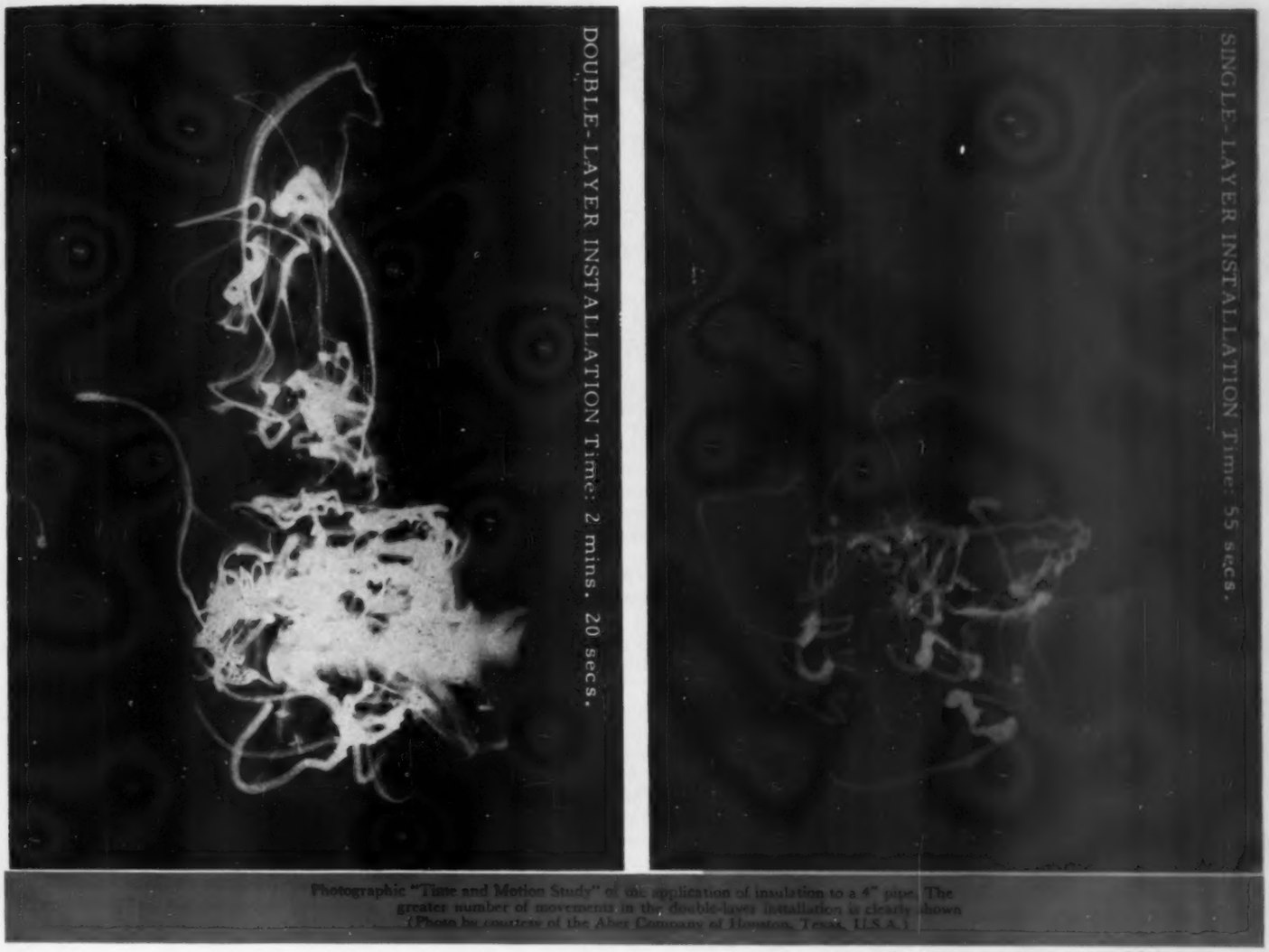
Frederic R. Harris Inc.

Consulting Engineers
144 East 44th Street
New York 17, N. Y.

Engineering for the Petroleum Industry
Marine Terminals
Gathering Systems
Offshore Structures

Construction Management
Studies, Design, Operation

Frederic R. Harris (Holland) N.V.
5 Korte Vijverberg
The Hague, Netherlands



Photographic "Time and Motion Study" of the application of insulation to a 4" pipe. The greater number of movements in the double-layer installation is clearly shown (Photos by courtesy of the Aber Company of Houston, Texas, U.S.A.)

Insulation in a single layer! Caposite was developed by The Cape Asbestos Company to avoid the two-layer compromise. Caposite does it in one—saving considerably on installation time and costs. Caposite, the amosite asbestos insulation, is designed to withstand temperatures up to 1000° F without loss of efficiency.

LOW JOINT LOSS

The fibrous edges of Caposite knit together at the joints giving a good heat seal and making staggered joints unnecessary.

EASY TO HANDLE

Its inherent strength makes it possible to handle Caposite in large sections—for example at 2" thick for 30" n.p.s.—with very little damage and a further saving in installation costs.

One layer—
less work
CAPOSITE single-layer insulation

CAPE

THE CAPE ASBESTOS COMPANY LIMITED 114 & 116 Park Street London W. 1. Grosvener 6022
Cables: Incorrupt London

Enquiries in Canada to: Cape Asbestos (Canada) Limited, 200 Bloor Street East, Toronto, Ontario
U.S.A. North America Asbestos Corporation, Board of Trade Building, Chicago 4, Illinois

Review of recent USA patents on catalysts

by Heinz Heinemann and P. A. Lefrancois

The last review on catalysts appeared in WORLD PETROLEUM, June 1959. The more than 60 patents discussed in this current digest testify to the activity of the field. These patents are concerned with catalyst preparation, activation and regeneration, rather than the processes in which the catalysts are used.

It is interesting to note that the great majority of patents deals with catalysts for cracking and reforming processes and that all other processes account for only relatively little effort. This would seem to indicate that no shift in the importance of the various catalytic processes used in petroleum refining can be expected. In reforming, increasing value is attached to catalyst regeneration and rejuvenation, showing that high severity operations are expected. In catalytic cracking, high alumina catalysts appear of considerable interest.

REFORMING CATALYSTS

More catalyst patents have issued in this than in any other review. This testifies to the continued heavy emphasis placed on catalytic reforming by petroleum research laboratories.

Molybdena-alumina catalysts are treated in a few patents. G. C. Hall, R. E. Kline and R. C. Zabor in 2,906,697 (to Gulf Res. & Dev. Co.) prereduce a molybdena reforming catalyst with hydrogen containing 0.5-15 mole % steam at 1050 F. In subsequent reforming of naphtha, improved yields and octane number are obtained. E. A. Hunter and M. A. Segura in Esso Res. & Eng. Co.'s 2,906,713 propose to improve catalyst activity by incorporating 1-15% zinc oxide into a molybdena-alumina catalyst. The catalyst support is prepared from sodium aluminate, aluminum sulfate and sodium silicate.

The bulk of new patents in this area deals with platinum type catalysts. K. K. Kearby (2,881,131 to Esso Res. & Eng. Co.) impregnates activated carbon with up to 1.2% Pt, dries, then impregnates with up to 2% aluminum chloride and heats to 900 F. According to Esso's 2,890,178 (J. P. Thorn and W. R. F. Guyer) alumina is impregnated with 1-35% platinum and dried. The resulting catalyst is mixed with alumina to give an overall Pt concentration of 0.1-1%. C. N. Kimberlin, Jr. and F. W. Steffgan in Esso's 2,890,179 spray dry alumina hydrosol ex aluminum alcoholate, separate 40-80 μ particles, impregnated with 0.3-2% Pt and blend with more calcined alumina to obtain a fluid reforming catalyst of 0.005-0.2% Pt content. In 2,898,289 Kimberlin and F. J. Buchmann describe a method of impregnation. A bed of alumina pellets is covered with water and chloroplatinic acid solution is added dropwise as the water circulates downflow through the bed and is being returned to the top of the bed. C. H. Worsham and C. W. Skarstrom (2,900,328 to Esso Res. & Eng. Co.) shock chill platinum or molybdena-alumina catalyst from calcination at 1100-1500 F. to room temperature in 15-50 seconds. Catalysts thus treated are claimed to give higher aromatics production.

In one of a group of patents assigned to Engelhard Industries, C. D. Keith (2,909,-481) doubly impregnates platinum on alumina to obtain a reforming catalyst with lower carbon producing characteristics. 65-95% alumina trihydrate is slurried, chloroplatinic acid added and the platinum precipitated with hydrogen sulfide. A platinum sulfide sol is then admixed, the mass dried and calcined. According to 2,867,-588, Keith and A. P. Hanel precipitate alumina from aluminum chloride and ammonia at a pH of 7-9.5. The washed cake is aged to obtain a maximum of 65-95% alumina trihydrate and impregnated with platinum.

In an M. W. Kellogg Co. patent (2,897,-137) E. F. Schwarzenbek mixes 1-25% platinum on alumina with additional alumina, to give a final Pt content of 0.05-0.95%. W. P. Burton, P. A. Lefrancois and E. W. Riblett in the same company's 2,888,397 use mercury or one of its volatile compounds as an activator of platinum-alumina prepared from platinous tetramine chloride. The activator improves catalyst selectivity. Impregnation of platinous tetramino-hydroxide on an acidic metal oxide, such as silica-alumina is proposed by J. E. Connor and C. S. Shipley in 2,884,374 (to The Atlantic Refining Co.). The acidic metal oxide should have a Birkhimer catalyst activity of 20-65.

E. B. Cornelius and F. W. Kirsch in Houdry Process Corp. patent 2,887,455 impregnate an alumina with chloroplatinic acid, after the calcined and steamed alumina has been treated with acetic or formic acid. The resulting catalyst gives higher octane numbers than a catalyst which has not been acid treated.

Reforming with a catalyst consisting of a mechanical mixture of particles of less than 100 microns diameter of a porous inert carrier containing platinum and of eta alumina containing halogen is proposed in Socony-Mobil Oil Co.'s 2,854,404 (C. D. Prater and P. B. Weisz). R. W. Baker, F. G. Ciapetta and R. M. Dobres (2,849,-378 to Socony-Mobil Oil Co.) reform with a platinum or palladium on silica gel catalyst, containing 0.025-7% alumina. Relations between surface area and alumina concentration are discussed. (See Fig. 1. Catalysts claimed fall within area ABGH.)

A method of making alloy catalysts of platinum and germanium on a support is disclosed by H. M. Stine, H. A. Strecker and R. B. Faris, Jr. in 2,906,700 (to Standard Oil Co., Ohio). The support is impregnated with an HCl solution of $GeCl_4$ and H_2 Pt Cl_6, dried and calcined in hydrogen at 900-1800 F. to form a solid solution of germanium and platinum on the support. Strecker and Stine in another Standard Oil of Ohio patent (2,870,084) impregnate platinum or platinum oxide on chromia-alumina catalyst and reform with this catalyst at low pressures. A Phillips Petroleum Co. patent (2,911,357; J. W. Myers and F. A. Prange) discloses a method to stabilize or decrease growth of platinum crystallites in a catalyst by incorporation of one of the following metals into the platinum-alumina catalyst: cobalt, ruthenium, manganese, copper, silver or gold.

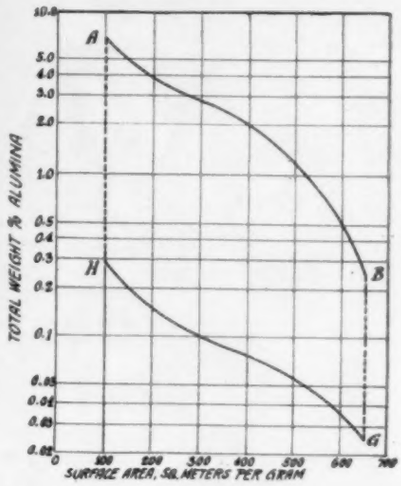


Fig. 1—Relationship between surface area and alumina content, U. S. 2,849,378, R. W. Baker et al.

PREPARATION OF ALUMINA SUPPORTS

Five Esso Research & Engineering Co. patents are applicable to both molybdena-alumina or platinum-alumina type catalysts. According to 2,894,900, C. E. Hemminger mixes a fluid alumina catalyst, containing 0.5-5% silica with molybdena-alumina or platinum-alumina for hydroforming in a fluid bed operation. G. R. Gilbert and I. Kirschenbaum (2,894,901) prepare reforming catalysts by hydrolysing butyl titanate and aluminum alcoholate, drying, calcining and impregnating with the active component. The alumina:titania ratio is about 1:1. C. N. Kimberlin in 2,895,905 discusses the preparation of reforming catalysts on alumina prepared from aluminum alcoholate by hydrolysis to hydrous alumina. J. A. Dinwiddie and M. A. Mosesman (2,889,268) prepare a heat stable gamma alumina by hydrolysing aluminum alcoholate with moisture laden air in six to

128 hours. The resulting boehmite gives upon drying and calcining a gamma alumina of high surface area and thermal stability. Eta alumina is produced according to I. Kirschenbaum and J. A. Hinlicky (2,903,418) by hydrolysing aluminum alcoholate at a pH of 3-5 with inorganic volatile acid or a C_3-C_5 organic acid. After aging for 5-18 hours at 60-80 C. beta alumina trihydrate is obtained, which on drying and calcining gives an attrition resistant eta alumina.

C. D. Keith in two patents to Sinclair Refining Co. discloses alumina preparations. According to 2,894,915 hydrous alumina is precipitated from aluminum chloride and ammonia. The alumina is washed with water containing carbon dioxide to prevent peptization. According to 2,898,307 an acid acting agent, such as sulfuric acid, aluminum sulfate or CO_2 is added to sodium aluminate solution to a pH of 11-11.5. Alumina trihydrate is precipitated and more acid agent added to obtain monohydrate and amorphous hydrous alumina.

R. H. Cramer and E. E. Jenkins in 2,898,306 (to Socony-Mobil Oil Co.) react basic aluminum chloride with urea and ammonia or ammonium acetate to give a hydrosol which sets to a hydrogel at pH 3.5-7. This is aged in hot oil for about 10 hours to hydrolyse urea, raising the pH to 8 or more, thus giving a strong alumina gel, which can be washed. Alumina is made from aluminum by G. L. Hervert and H. S. Bloch (2,871,096 to Universal Oil Products Co.) by adding 100-2500 ppm of iron to the aluminum and then reacting with water in the presence of 0.05-50% mercury. R. Tertian and D. Papee in Pechiney Co.'s 2,876,068 grind Bayer process alpha alumina trihydrate to 1-2 micron size and calcine to give an activated alumina. The grinding prevents formation of monohydrate on heating.

CATALYST PRETREATMENT

Marked improvement in the activity of a palladium-alumina catalyst is claimed by W. P. Hettinger in Engelhard Industries' 2,893,948, if the catalyst is pretreated with oxygen at 1200-1500 F. for at least 15 hours. T. F. Doumani in Union Oil Co.'s 2,897,135 treats desulfurization, reforming or hydrogenation catalysts with ozone at —50 to 570 F. and then reduces with hydrogen at 500-1200 F. Improvement of catalyst activity is claimed. S. G. Hindin and H. Shalit (2,908,656 to Houdry Process Corp.) improve resistance of noble metal catalysts to deactivation by oxygen or water. Dried platinum-alumina catalyst is reduced in pure dry hydrogen at 500-1000 F. and less than 100 psi pressure and is then cooled in the same hydrogen down to 250 F. before any exposure to air, oxygen or water containing gas.

CATALYST REACTIVATION

J. R. Coley and R. J. Henjstebeck in one of several Standard Oil Co. (Indiana) patents on this subject (2,892,770) have found that sulfur dioxide in regenerator flue gas containing oxygen can go to sulfur trioxide and attack the alumina of reforming catalysts. They, therefore, scrub all regeneration gases with water, containing 0.01-1% caustic.

Two other Standard Oil Co. (Indiana) patents issued to H. M. Brennan, R. W. Van der Haar, and H. S. Seelig disclose methods of reactivating decarbonized platinum-alumina catalysts by treatment with halogen or halides. In 2,906,702 the treatment is with chlorine at 700-1100 F. for 0.25-24 hours, followed by steaming or aqueous ammonia treatment. In 2,910,429 aluminum chloride is deposited in amounts from 0.1-3% on the catalyst from a vapor stream at 250-1050 F. The catalyst is subsequently reduced with hydrogen.

R. V. Malo and G. M. Webb, 2,879,232 to Standard Oil Co. (Ind.), regenerate platinum type catalysts in the usual way to below 0.1% C and then treat with oxygen containing gas at 950-1300 F. to remove the remaining carbon and convert most of the platinum to platinum oxide. L. V. Robbins, Jr. and L. A. Nicolai in Esso Res. & Eng. Co. 2,905,631 regenerate a contaminated hydroforming catalyst in a fluid bed with an oxygen containing gas. The amount of oxygen is controlled so that the exit gas from the regeneration does not contain more than 1% free oxygen.

R. T. Loughran and W. P. Burton in M. W. Kellogg Co.'s 2,867,579 regenerate molybdena-alumina catalysts by burning off carbon, treating with hydrogen containing 0.1-10 mole % water and reforming in the presence of 0.25-3 mole % water.

In an Imperial Chemical Industries patent (2,897,157) R. E. Goddard regenerates a granular catalyst in a moving bed under conditions conducive to good temperature control.

CRACKING CATALYSTS

As at other times, cracking catalysts constitute the second largest group of new catalyst patents.

High alumina cracking catalysts are the subject of several patents. In Sinclair Refining Co.'s 2,872,410 H. Erickson describes a method of preparing a catalyst containing 27-35% alumina. An aluminum salt is incorporated into silica hydrosol before it gels. The pH is adjusted with sulfuric acid to not more than 3 to gel the silica and alumina trihydrate is precipitated with ammonia. H. J. Ogorzaly (2,908,635 to Esso Res. & Eng. Co.) reacts sodium silicate with sulfuric acid to give a hydrosol at a pH of 3.5-5.5. At one half the time required for gel formation, aluminum sulfate solution is added to a pH of 1-3 and ammonia admixed to a pH of 7. M. E. Winyall in W. R. Grace Co.'s 2,886,512 adds carbon dioxide to sodium silicate solution to give a pH of about 10, ages for one half hour, adds aluminum-sulfate solution to a pH of 6, ages for five minutes prjor to washing and drying.

Cracking catalysts containing calcium and/or magnesium are described by R. E. Van Dyke and J. N. Wilson in Shell Dev. Co.'s 2,886,511. The calcium or magnesium salt solution is added to sodium silicate solution, the pH adjusted to about 10 and an aluminum salt and ammonia added to a final pH of 9.5. The final catalyst contains 12-30% Al_2O_3 and 1/50 to 1/5 mole magnesium or calcium oxide per mole of silica. R. P. Sieg and G. R. Barber in 2,870,082 (to California Res. Corp.) form a hydrous coprecipitate of silica-alumina containing 20-60% Al_2O_3. Silica or silica with 0-10% Al_2O_3 or magnesia or zirconia or thoria is dispersed in the coprecipitate to yield a final catalyst containing 5-20% alumina. The graphs in Fig. 2 shows the improved selectivity of a catalyst, having 30-35% alumina in the first coprecipitated gel.

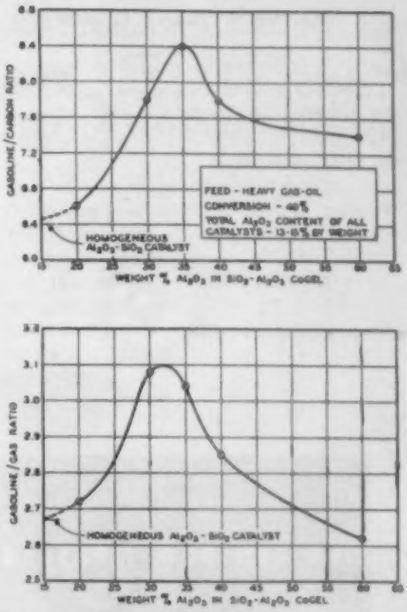

GASOLINE/CARBON RATIO
FEED - HEAVY GAS-OIL
CONVERSION - 40%
TOTAL Al_2O_3 CONTENT OF ALL CATALYSTS - 13-15% BY WEIGHT
HOMOGENEOUS Al_2O_3-SiO_2 CATALYST
WEIGHT % Al_2O_3 IN SiO_2-Al_2O_3 COGEL
GASOLINE/GAS RATIO
HOMOGENEOUS Al_2O_3-SiO_2 CATALYST
WEIGHT % Al_2O_3 IN SiO_2-Al_2O_3 COGEL

Fig. 2—Improved selectivity of silica-alumina cracking catalyst having 30-35% alumina in gel. U. S. 2,870,082, R. P. Sieg et al.

A titania catalyst is disclosed in Esso's 2,886,513 (E. G. Baker). A calcium salt is added to the hydrous titania, which is then directly calcined. Baker and I. Kirschenbaum describe in Esso's 2,889,266 a magnesia-beryllia catalyst, which produces a more olefinic and less aromatic gasoline than conventional silica alumina. The preferred composition is 35-65% BeO and 65-35% MgO.

Patent 2,890,162 by J. A. Anderson, Jr., J. A. Dinwiddie, M. A. Mosesman and L. W. Vernon (to Esso Res. & Eng. Co.) shows that pore size enlargement of gamma alumina helps the desulfurization of higher boiling hydrocarbons. Mathematical correlations of pore size distribution factor with performance are claimed.

Two Sun Oil Co. patents deal with chromia containing catalysts. In 2,867,578 A. E. Hirschler impregnates 0.2-7% beryllia and 1-12% chromia on silica-alumina cracking catalysts to increase the olefin content

(*Continued on page 74*)

Review Of Recent Patents

(*Continued from page 73*)

of cracked, gaseous hydrocarbons. According to 2,897,134 Hirschler and E. J. Janoski impregnate 0.5-10% chromium phosphate on silica-alumina.

A method to remove contaminants from cracking catalyst particles is discussed by T. H. Milliken, Jr. in Houdry Process Corp's 2,892,771. A side stream of moving bed catalyst particles is withdrawn and treated with a gas containing abrasive particles of 100-800 μ, which remove contaminants from the periphery of the catalyst particles.

MISCELLANEOUS CATALYSTS

Catalysts for the selective hydrogenation of acetylene in olefins are described in two patents. H. C. Anderson and A. J. Haley in 2,909,578 to Engelhard Industries uses 0.00001 to 0.0014% palladium on activated alumina. H. W. Flemming and R. E. Reitmeier in 2,897,160 (to Chemetron Corp.) employ cobalt molybdena, which is dried and mixed with a cement-ball clay-alumina composition.

A noble metal hydrogenation-dehydrogenation catalyst without acid function is claimed by H. Heinemann and H. Shalit in Houdry Process Corp.'s 2,908,654. Platinum on gamma alumina is treated with a steam-hydrogen mixture at 700-1000 F. for 1-36 hours to reduce the Cl content to less than 0.1%.

An iron-alumina catalyst is the subject of J. Hoekstra and E. Michalko in Universal Oil Products Co.'s 2,897,159. An alumina-iron hydrosol is formed, all iron oxidized with hydrogen peroxide and the sol gelled with hexamethylene-tetramine. Another U.O.P. patent (2,871,199; M. S. Bielawski) discloses an improved solid phosphoric acid polymerization catalyst. Polycyclic aromatics are dissolved in carbon tetrachloride and the solution is added to diatomaceous earth. After solvent removal the dry powder is admixed with polyphosphoric acid, extruded, dried and calcined.

An alkylation catalyst, which is the reaction product of aluminum chloride and an alkane or aryl sulfonic acid is described by H. D. Kluge and F. W. Moore in Texas Co.'s 2,868,823.

Three Sinclair Refining Co. patents deal with molybdena catalysts. C. D. Keith in 2,908,655 forms a slurry of an inorganic metal compound which is water insoluble and an acidic oxide of molybdenum, also water insoluble, at about 100 F. and adds it to a catalyst support, while milling, then extrudes, calcines and dries. J. W. Teter, J. L. Gring and H. Erickson in 2,898,305 disclose a method of impregnating cobalt, nickel, iron, molybdena or tungsten on alumina or magnesia. In 2,897,161 Erickson claims a process for improving the hardness of a cobalt molybdena alumina catalyst by soaking the formed, calcined catalyst in water for about 100 hours, drying and recalcining.

A superior desulfurization catalyst described and claimed by R. C. Hansford in Union Oil Co.'s 2,911,359 comprises 3-25% vanadium oxide on a calcined alumina, containing about 5% silica and 0.1-5% magnesia. END

Another achievement in gravity measurement from LaCoste & Romberg

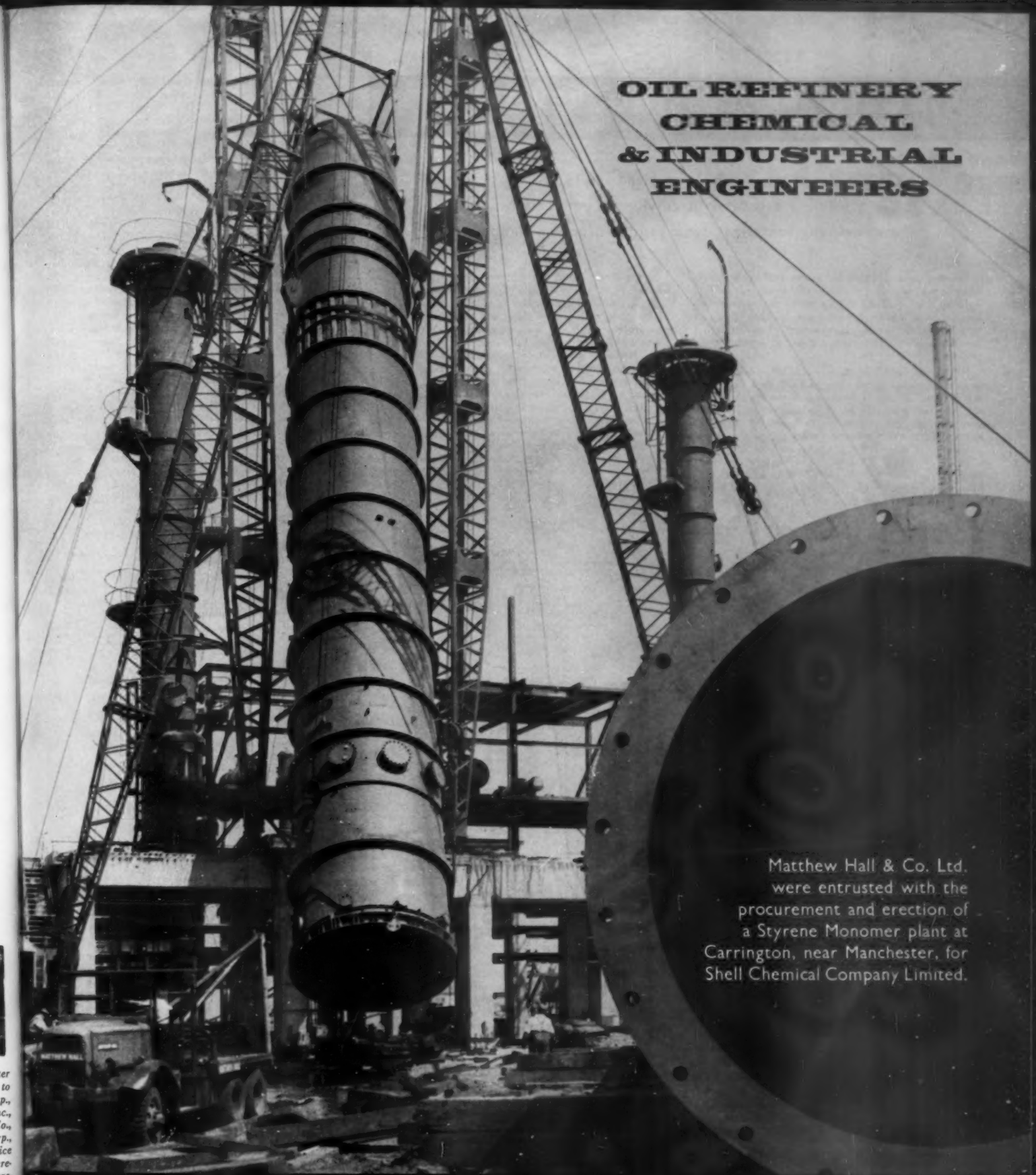
Now for the first time, gravity surveys of inaccessible areas can be made from the air, using a LaCoste & Romberg airborne gravity meter. This new meter requires no gyroscopic stabilization platform. Its accuracy is better than 10 milligals.

Commercial airborne surveys are now available from Fairchild LaCoste Gravity Surveys, Inc.

LaCoste & Romberg 6606 NO. LAMAR AUSTIN, TEXAS

Manufacturers of airborne, submarine, shipborne and surface gravity meters for both exploration and geodetic surveys

Incoming and retiring officers of the Los Angeles Chapter of Nomads at the annual business meeting. From left to right (seated) P. M. Bowen of Martin-Decker Corp., treasurer; Jack S. Smith of Byron Jackson Tools, Inc., sergeant-at-arms; Tom R. Ashe of Globe Oil Tools Co., regent; Taylor Bannerman of Technical Tool Corp., president; Charles M. King of Baker Oil Tools, Inc., vice president; Lester G. Evans of Axelson Mfg. Co., secretary; C. C. Sutton of Oil Well Mfg. Co., assistant secretary, (standing) B. Bronzan of McCullough Tool Co., deputy sergeant-at-arms; Willard Goertz of Monarch Engineering Corp., assistant treasurer; Robert P. Gaylord of Wagner-Morehouse, Inc., regent; Earl M. Daniels of Hydril Co., regent; Knight Templeton of Bowen ITCO, (treasurer 1959).


OIL REFINERY
CHEMICAL
& INDUSTRIAL
ENGINEERS
Matthew Hall & Co. Ltd. were entrusted with the procurement and erection of a Styrene Monomer plant at Carrington, near Manchester, for Shell Chemical Company Limited.
THE
MATTHEW HALL
GROUP OF COMPANIES

WORLD PROCESSING REVIEW

By Wm. C. Uhl, Processing Editor

Highlights of the month—a new lead alkyl additive for gasoline, a new catalytic ethylbenzene process, two new engine designs, some caution urged on computers

Another new additive for motor fuel seems fairly close to reality with the public announcement in January by Socony Mobil Oil Co. of its successful development of a tetramethyl lead anti-knock agent, said to give better octane improvement than tetraethyl lead in catalytically reformed types of gasoline components.

The major benefit in the use of TML, Socony says, is in overcoming knock due to what they call "fuel segregation," which is described as the separation of the gasoline into portions of varying volatility as it goes through the engine intake manifold. The resultant non-uniform mixture causes knock not otherwise expected when it reaches the combusion chambers.

Research behind TML was prompted by the stubborn knock being met in certain European automobiles using today's fuels. Socony technologists found the octane numbers of the fuels were high enough to meet the supposed requirements of these cars, yet the engines continued to knock. Later, the knock appeared also in some USA cars. Surveys of cars made throughout the non-Communist world showed that a high percentage of cars with manual transmission exhibit the fuel segregation problem, and a much smaller percentage of cars with automatic transmission exhibit fuel segregation. Under these conditions, Socony found that TML gave substantially higher (2 to 6 octane numbers) road ratings than did TEL.

In addition, TML benefits all cars using catalytically reformed gasolines. The road octane "bonus" is smaller in other cars, but still significant—1 to 2 O.N. TML also raises Research and Motor octane numbers of cat reformed gasolines when measured by conventional rating procedures. The increase varies with composition, being about 2 O.N. higher than with TEL in the case of highly aromatic reformates.

The primary significance of this development is its potential impact on the use of other octane improvement processes such as alkylation, isomerization, and the like, provided economics are favorable. Because TML is more effective than TEL in some stocks, it should give a refiner greater flexibility in blending motor fuel to meet changing markets. There is a potential for TML outside the USA because catalytic reforming is being put to widespread use in all parts of the world. The new additive should assist such refinery operators in overcoming the fuel segregation problem.

No cost figures are available as yet, but Socony has submitted its findings to TEL manufacturers for cost estimates on commercial production of the new TML material. The company said its own studies show TML can be produced at economically attractive prices.

Initially, the primary use of TML would be in gasolines high in aromatics and low in olefins; however, Socony feels that eventually the material could probably become the major anti-knock agent.

Patents have been applied for in some countries and others are in the course of being applied for. Socony said none of the many existing, or already expired, patents on organo-lead anti-knocks covers specifically the use of tetramethyl lead in highly aromatic gasolines. Safety is also being checked, and the company stated it will not use TML until approval has been given by the U. S. Surgeon General.

Socony has not been alone in its research efforts in this field, as revealed in comments by other companies following the Socony announcement:

William J. Sweeney, vice president, Esso Research and Engineering Co., pointed out that fuel segregation has been recognized for some time as a problem in addition to the more generally known high compression ratio knock problem. He went on to say:

"To solve both these problems we have long been working on various lead alkyls as motor gasoline additives. On Feb. 9, 1943, a U. S. patent was issued to our company covering the application of these alkyls to motor fuel in order to eliminate compression knock and to obtain better distribution of the anti-knock components to the various cylinders. Tetramethyl lead in particular was described in this patent, which was also granted in several European countries."

More recently, he said, experimental work carried out by Esso Research Ltd.—the company's affiliate in England—demonstrated that knock phenomena being produced at acceleration in a few types of European engines by certain European gasolines could be overcome in several ways, including the use of tetramethyl lead as a fuel additive.

Both Ethyl Corp. and du Pont reported they have been working for a considerable time on TML types of additives and are ready with commercial processes for its manufacture. Prices and availabilities in commercial volumes have not yet been established, however. Also, safety studies have indicated no significant differences in toxicity between TML and TEL.

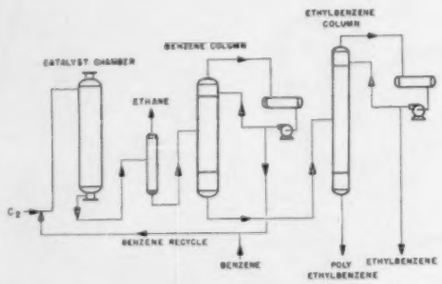


Fig. 1—Simplified flow of UOP ethylbenzene unit.

Successful commercial production of ethylbenzene using a new type solid phosphoric acid catalyst in the alkylation of ethylene-benzene has been reported by Edwin K. Jones of Universal Oil Products Co. The plant has been operating some seven months at El Paso Natural Gas Co., Odessa, Texas, producing ethylbenzene which is subsequently dehydrogenated to styrene with a purity between 99.75 and 99.9%, following fractionation.

Still running on the original charge of the new phosphoric acid catalyst, the ethylbenzene unit continues to give a high ethylene conversion rate. It started at 98%, and is presently at 70%, the reduction due primarily to pushing the unit beyond design capacity with only a partial catalyst charge. The ethylbenzene product normally has a purity of 99.9% or higher.

The new catalyst, designated as UOP No. 4 Polymerization Catalyst, differs considerably from earlier solid phosphoric acid catalysts; however, the company has not disclosed its exact nature. Although it is useful also for polymerization, when used for ethylbenzene manufacture it has higher activity toward primary alkylation reaction and lower activity toward the undesirable polymerization side reaction under these conditions.

Flow in the Odessa unit is shown in the chart (Fig. 1). Charge to the process is a C_2 and lighter gas stream containing 20% ethylene, obtained from a propane cracking unit, and high-purity benzene. The unit, designed and licensed by UOP, comprises a feed absorber, reactor, gas separator, benzene fractionator, and ethylbenzene fractionator.

Total feed stream from the propane steam cracker is absorbed in benzene and the resulting liquid passes through feed heaters into the reactor. Benzene separated from reactor effluent recycles back to the reactor. Overhead product from the final column is the 99.9% ethylbenzene. Typical composition of bottoms in wt-% is: ethylbenzene, 2.6; diethylbenzene, 67.8; cumene, 9.1; triethylbenzene, 2.7; and butylbenzene, 17.8.

This process is *not* the new UOP "Alkar" process, which was announced in May, 1959, and the first commercial unit of which is to be installed by Cosden Petroleum (see "Petrochemicals" below).

New automotive engine designs aimed at simplified fuel requirements continue to come to industry's attention. Two more with intriguing potential were announced recently; one in Germany and the other in Michigan.

In West Germany, NSU Werke has developed what is said to be a usable application of an older idea, a rotating piston engine, which requires no special gasoline as fuel and weighs about ¾ lb per hp in the prototype model (32 hp from a 24 lb unit). Basically a spark-ignited engine, it consists of a triangular shaped piston that rotates within an odd-shaped cylinder. It is designed so that a power-producing phase takes place simultaneously at three stages of development. A key problem that is solved in the new NSU design is the sealing of the moving combustion chambers created between the cylinder walls and the piston sides during piston rotation.

The Michigan development is a lightweight gas turbine proposed as the answer to the need for such a power plant for automobiles and especially for the small cars. It was developed by Sam Williams of Williams Research Corp., who worked with Chrysler Corp. on reciprocating and turboprop engines before he formed his own company five years ago.

A 75-hp prototype version has been built and operated successfully driving a small power boat on the Detroit River during some 15 months of testing. The engine weighs about one lb per hp (compared with 2 or 3 lb/hp for other gas turbines) and is about the size of a breadbox. Williams says it provides fuel economy approaching that of most modern piston engines and it can operate on kerosine, jet fuel, diesel fuel, or straight gasolines.

No design details have been revealed, but Williams said that a new type of heat exchanger is employed to recover exhaust heat, normally wasted.

Some words of caution on computers were spoken by a du Pont engineer at the American Institute of Electrical Engineers meeting in New York in February, who advised thorough study before "leaping to buy" costly computing equipment.

Pointing to the furor caused by automation in other manufacturing and the doubtful results sometimes obtained, C. R. Hall said: "A similar stage appears to be set in the application of digital computers for control of chemical processes. There is much talk in broad generalities of the push-button plant, of a digital computer (perhaps even located in a distant city) controlling vast chemical operations. There is much secrecy surrounding what is actually being accomplished today . . ."

He urged those who are seeking improved process control systems to:

1. Seek lower cost alternative solutions to problems at every step. A big help is to bring in someone *unfamiliar* with computer possibilities.
2. Use a strong mathematician or statistician, or both, on the team of researchers.
3. Seek out situations where there are random upsets which change fairly rapidly with time and where there are two or more controllable independent variables.
4. Seek for interaction between independent variables upon the results desired. If there is no interaction, you may have no real problem.

What's New in Processing Plants

Sociedad Nacional de Refinacao de Petroleos (SONAREP) has awarded Procon (Great Britain) Ltd. a contract to build Mozambique's first refinery, a 12,000 b/d plant. SONAREP is a subsidiary of the Portuguese firm, Sociedad Nacional de Petroleos. Completion is expected early in 1961, and cost has not been disclosed. Downstream units will include a 2,500 b/d Platformer, 2,000 b/d diesel oil Unifiner, 1,500 b/d Merox treater, and auxiliaries.

• • •

Esso Sirte, a wholly-owned subsidiary of Standard Oil Co. (N. J.) will build Libya's first refinery, a 4,000 b/d plant, at a site to be determined. The project is part of an arrangement whereby Esso Sirte acquired half interest in three concessions held by Libyan American Oil Co. and W. R. Grace & Co. in Cyrenaica and Tripolitania.

• • •

Royal Dutch/Shell plans a $50 million expansion at its Clyde, Australia, refinery, centered around a

LIBYA

Dynamite for shot-firing being carried across country by camel train. BP Exploration Company (Libya) Limited is now searching for oil over six concession areas in Tripolitania, Cyrenaica and the Fezzan.

BP

$38 million, 11,750 b/d catalytic cracking unit, and scheduled for completion in three years.

• • •

Istanbul Petrol Rafinerisi, A.S., a new company, will own and operate a new 20,800 b/d refinery to be built by Caltex and a government company, Turkiye Petroleri, A.O. The main construction contract was awarded to M. W. Kellogg, and the $26.65 million plant will be erected at Izmit, a deepwater port near Istanbul. Process facilities will include a naphtha Unifiner, Platformer, distillate hydrotreater, and fluid catalytic cracking unit.

• • •

Work has started on a new $17 million gas processing plant and gathering system in the Homeglen-Rimbey and Westerose South fields of central Alberta. British American Oil Co. Ltd. will operate the 326 mmcfd plant, and Poole-Pritchard Canadian Ltd. has the construction contract.

• • •

A program of expansion and unit revamp under way at British American's Calgary, Alta., refinery will boost crude capacity from its existing 7,500 to 10,000 b/d.

• • •

Sunland Refining Co. has placed onstream a new 400 b/d UOP Merox unit at its Bakersfield, Calif., refinery.

• • •

Bitumen and Oil Refineries (Australia) Ltd. plans to raise an additional $4.5 million capital to finance a new fluid cat cracker at its Matraville, NSW, refinery.

• • •

New Honolulu, Hawaii, refinery being built by Standard Oil of California.

Standard Oil of California plans futher expansion of the Hawaiian refinery now under construction near Honolulu. The new facilities, which will nearly double the company's original $33 million investment, will include a 13,000 b/d fluid catalytic cracker, alkylation, hydrogenation, and isomerization units, a carbon monoxide boiler, sulfur recovery, and additional tankage. Current construction will be complete this October on the 32,000 b/d refinery; the additional equipment will be onstream by about the middle of 1962.

• • •

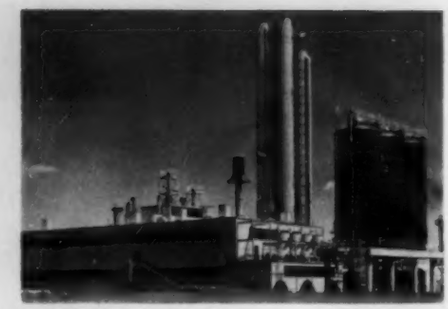
The first USA installation of an Italian patented process for acid gas removal is being readied for operation near Fort Stockton, Tex. The process is the Giammarco-Vetrocoke process and the plant was designed and constructed under license by Brown & Root Inc. for Transwestern Pipeline Co. It will treat 180 mmcfd of 1,050 psig natural gas containing 28% carbon dioxide and up to 0.2% hydrogen sulfide. Plant startup will be timed to match completion of Transwestern's Texas-California pipeline.

What's New in Petrochemicals

Texas Butadiene Co. has completed negotiations with the Argentine government oil firm, YPF, for investment of $39 million in a synthetic rubber and carbon black plant in Puerto Deseado, to operate on natural gas from the Santa Ruz province.

• • •

W. R. Grace & Co. has acquired controlling interest in the common stock of Cosden Petroleum Corp., 1,580,000 shares at $25 a share, slightly over 51% of the 2,970,000 outstanding shares of common. Cosden has just announced it will triple its styrene capacity, to 60 million/lb/yr, with two new units to be completed late this year. Contract for design, engineering and construction of the entire project, including additional monostyrene facilities as well as the first Universal Oil Products Co. "Alkar" unit in the USA, has been awarded to Badger Mfg. Co. The additional



Cosden Petroleum's poylystyrene facilities, with styrene monomer towers in background, capacity of which is being trebled.

ethylbenzene required for the styrene unit will be produced by the new Alkar process, announced last May by UOP, in which benzene from Cosden's BTX unit, will be catalytically alkylated with ethylene from cracking unit residue gas.

• • •

Jefferson Chemical Co. has purchased former Warren Petroleum Co. manufacturing facilities at Conroe, Texas, from Gulf Oil. Jefferson will use the facilities for development work on new processes pilot planted at Austin research laboratories. A new process for morpholine is to be undertaken soon at Conroe also, as well as work on intermediates for polyurethanes. Total employment at Conroe will reach 44 late this year.

• • •

Olin Mathieson Chemical Co.'s new ethylene oxide plant at Doe Run, Kentucky—part of a $30 million expansion for the Chemicals Division—is scheduled to go onstream late in 1960. Engineered and constructed by The Lummus Co., the unit will employ Shell Development Co.'s process for the direct oxidation of ethylene, and it is the fourth such unit to be designed, engineered, and built by Lummus in the last several years.

• • •

DX Sunray Oil Co. will complete a 600 b/d (benzene) Udex unit at Tulsa in October. Refinery Engineering Co. has the construction contract. The unit will also produce 300 b/d of toluene.

• • •

Oronite Chemical Co., a subsidiary of Standard Oil of California, has entered into a new joint venture in France to produce paraxylene at a new multi-million dollar plant scheduled for completion late in 1960 at Donges near St. Nazaire. The new company, Societé Californie-Atlantique, is now being formed by Oronite and principal shareholders of Antar Petroles de l'Atlantique and Societé Progil. Chief customer will be Rhodiaceta, France's largest synthetic fiber producer, which has recently completed new facilities to produce its synthetic fiber, Tergal, which will be made from the paraxylene.

• • •

Monsanto Chemical Co. has started building alkyl phenol facilities at Kearny, N. J., to be used primarily in the company's manufacture of alkyl phenol-based ethylene oxide condensates. Completion is scheduled for September. Cost and capacity were not announced.

• • •

Delhi-Taylor Corp. has completed a new 2 million gallon petrochemicals marketing terminal at North Charleston, S. C., for distribution of toluene, xylene, and other solvents to the textile, paint, and chemical industry in the southeastern USA.

• • •

Gulf Oil Corp. has started production of high purity cyclohexane at a new facility at Port Arthur, Texas, built by Procon Inc. and using a process licensed and engineered by Universal Oil Products Co. The plant is the first installation by an oil company producing cyclohexane from benzene.

• • •

United Carbon Co. will form a French subsidiary to build a $5 million carbon black plant near Rouen, to be finished early in 1961 with an initial rated capacity of 50 million lb/year.

• • •

Rexall Drug and Chemical Co. has created a new chemical division. President of the new division is Ralph M. Knight, formerly vice president and polyethylene manager of National Distillers & Chemical Corp. and before that with du Pont. Vice president in charge of production is John R. Provo, formerly division superintendent of polyethylene manufacture for du Pont. Both men will headquarter at Los Angeles.

• • •

The first chemical plant in the USA to use direct, on-line computer control of any over-all chemical process has begun start-up operations at Monsanto Chemical Co.'s Luling, La., facilities. The unit, an ammonia manufacturing operation, is using an RW-300 Digital Control Computer made by Ramo-Wooldridge, and thus far performance has been as anticipated, according to Monsanto.

• • •

Sinclair Oil Corp. and Koppers Co. Inc. have announced joint plans to build a new 70 million lb/yr styrene monomer plant at Houston, Texas, with completion and initial operation expected by mid-1960. Sinclair will supply raw material from the nearby refinery, and Koppers will use or market the styrene output. A new corporation is to be formed to own and operate the plant.

• • •

Dow Chemical International Ltd. S.A. will form a new company, Dow Chimica Italiana S.p.A., and build a new manufacturing plant in Italy. The site has not yet been selected, and a number of products are being considered, one of which would be the entire line of polystyrene. The new company will open an office in Milan this spring.

• • •

An expansion in petrochemicals in New South Wales will take place under an agreement between Shell Chemical (Australia) and Imperial Chemical Industries. Shell will build an ethylene plant at Clyde, product from which will be piped to ICI at Botany to make polymer. Clyde construction is scheduled for completion by 1962. Cost of this and the Botany expansion is £A 10 million.

• • •

Union Carbide (Australia) has awarded a £A 4 million contract to George Wimpey & Co., London, to build a polyethylene plant at Altona, Austral, part of a new £A 23 million petrochemical and synethetic rubber project.

• • •

New Petroleum Committee

The National Petroleum Council has set up a special Committee on Petroleum Refinery Maintenance and Chemical Requirements to make a thorough study of the maintenance supplies and process chemicals needed for continuance of refinery operations under short-range emergency conditions. The committee, headed by Everett Wells, president, Ashland Oil and Refining Co., will survey all USA refineries in its study.

New Fuel Oil Additives

Tretolite Co. Division of Petrolite Corp. has introduced a new line of fuel oil additives under the trade name "Tolad." Two types are available: an inhibitor, or preventive, type, and an inhibitor-dispersant type. The first is usually most effective for fuels for domestic units or where maximum reduction of insoluble residue and sludge is of prime importance. The latter is usually preferred for diesel fuels; beside reducing the quantity of insoluble residue, it also reduces residue particle size.

New Price Schedule on Dabco Catalyst

A new commercial price schedule for Houdry Process Corp.'s triethylenediamine catalyst, "Dabco," for producing urethane foams, coatings, and elastomers, has been established with the start-up of a new plant in Paulsboro, N. J.

Remote Flow Metering

The latest equipment for remote flow measurement of onstream petroleum products was shipped recently by Granberg Corp. from its Oakland, Calif. plant to a Louisiana location, where it will be used on a range of materials from gasolines through No. 2 fuel oils. The primary sensing element is a 12-in. diameter, turbine-type meter with a rated capacity of 7,100 bbl/hour, capable of operation at pressures up to 300 psi.

NATURE'S CATALYSTS (6)

Fertilizer from the Air

Between 1730 and 1738, 'Turnip' Townshend introduced the Norfolk four-course rotation to British agriculture. In this system of rotation, a crop of clover or other legume was used to enrich the fields, making possible a higher yield of wheat in the following year. The reason for this was established in 1862, when it was found that a species of bacterium infests the roots of legumes, and frequently gives rise to enormous numbers of gall-like nodules upon them. This bacterium contains an organic catalyst that fixes atmospheric nitrogen and converts it into valuable nitrogenous salts.

Many syntheses at one time performed only by bacteria now take place in modern chemical plant with the aid of man-made catalysts. I.C.I. offers a catalyst for use in the synthesis of ammonia from atmospheric nitrogen, other catalysts from the I.C.I. range being used in the manufacture and purification of the hydrogen component.

Information on the full range of I.C.I. CATALYSTS is available on request.

IMPERIAL CHEMICAL INDUSTRIES LIMITED ICI LONDON S.W.1

B.375

Wildcatting Is World Wide

(Continued from page 43)

Burmese government will drill five or six 5,000-ft wells in the Yenangyaung area during 1960. The first well will be drilled on the south side of the Pin Chaung.

Indonesia: Little exploratory drilling is going on. Caltex is actively producing its fields (up to 180,000 b/d at the end of 1959) and Stanvac is doing exploratory drilling. In Central Sumatra it includes some nine shallow wells near Sekean Lesung and one near Lirik Station No. 1. In South Sumatra Stanvac is drilling two shallow wells near the Selo field. Shell is not believed to be wildcatting.

Japan: Using a heavy rig newly purchased in the USA, a new offshore field was found off Niigata prefecture during 1959 and drilling is continuing there. A wildcat is also being drilled near the Sarakawa field.

Pakistan: Wildcatting is being done by Standard Vacuum, Sun Oil, Attock Oil, Burmah Oil, and Shell. Hunt has pulled out after 11 dry holes. Pakistan Petroleum Ltd. (Burmah Oil) made a discovery in 1959 at Karsal No. 3 and is drilling offset wells. Stanvac had one well drilling on Jan. 13 in East Pakistan. Bogra 1, north and east of Kuchma 1, was dry in 1959 at 9,433 ft. Stanvac is not drilling now in West Pakistan so far as is known, but has made a gas discovery in its Mari well.

Papua: One well was drilling at the beginning of 1960 by Australasian Petroleum, the long suffering consortium there which includes Standard Vacuum, BP and Oil Search Ltd. Bwata 1 was drilling at 7,088 ft at the beginning of the year with no shows reported. Puri 1, 1A and 1B have all been abandoned. The company will drill its next hole at Ichi. The Bwata well is still drilling in tertiary limestone and having passed through several gas shows appears to be drilling in a water zone. The gas shows will be tested but there now appears little prospect of obtaining commercial oil in this hole.

Prospecting work carried out over the years now leads the company to the opinion that the best prospect for commercial oil accumulations are the mesozoic sands to the north and northwest of Barikewa in the region where several anticlinal structures of considerable size are known to exist.

Papuan Apinaipi Petroleum Co. Ltd. is planning more wells and has joined forces with Associated Australian Oilfields, N.L., and Associated Freney Oilfields, N.L.

Philippines: The first commercial oil discovery has been made by Republic Resources and Development Corp. (Redco) and drilling is continuing at an offset well, Reina Regente 1-A-X, below 5,200 ft as of Dec. 2, 1959. Philippine Oil Development Co. spudded Tigbauan 1 in Panay but abandoned it at the end of November. Maremco Mineral Corp. is drilling a shallow (3,000 ft) test in Negros. No shows are reported.

Taiwan (Formosa): Chinese Petroleum Corp. is the only exploring company. It is actively drilling and has recently added a heavy rig. Six wells were drilling at the beginning of 1960, as shown in accompanying tables. Total meterage drilled in 1959 was 11,421.

New Guinea: NNGPM company is drilling several wells. As of Jan. 18, 1960, Klamono 42 was at 492 ft, Klasofo A was at 1,985 ft, Klawotong was drilling (all are in the northwest corner, near Vogelkop). Jaosakor was at 7,329 ft and appears to be dry.

New Zealand: Shell/BP-Todd are exploring with one rig and drilling a deep test to over 10,000 ft in the Mangaone district near Nuhaka in Hawkes Bay Province. The company found some oil and wet gas in Kapuni No. 1 during 1959.

North America

Canada: About 223 wells were being drilled in Canada at the end of 1959, all but one in Western Canada. The total compared favorably with the same period in 1958 when only 193 were drilling. The final well count for 1959 shows 2,515 wells completed in Western Canada, down about 3% from 2,588 in 1958. Forecasts indicate that the next two or three years will remain at about 2,500 wells annually.

No major oil finds were made in 1959 and no unusually good strikes have been reported in the first month of 1960. Productive capacity in Canada is far above market outlets in any case, and the industry is only producing about 45% of capacity.

Alaska: Six wildcats were drilling at the end of 1959, according to the Alaska Scouting Service. They included Standard Richfield drilling Swanson River Unit No. 14-27, Swanson River Unit No. 32-22, and Soldotna Creek Unit No. 41-4; Union-Ohio drilling Kenai Unit Well No. 33-30 (all the above are more on the development than wildcat side); Alaska Consolidated Oil drilling Iniskin-Antonio Zappa 1 and Iniskin Unit Operators No. 1 (Beal No. 1). Benedum & Associates were drilling Nulato Unit No. 1. Richfield Oil Corp. spudded in Kaliakh 1, its initial test well in the Katalla-Yakataga area of southwest Alaska in early December. The well is located about 75 miles east of the Katalla field, which produced some oil in the period from 1903 to 1933.

Mexico: Pemex plans to drill 477 wells in 1960, of which 121 will be exploratory. The budget for Pemex is now nearly as large as that of the entire Mexican government. So far as known, there were no major onshore discoveries in Mexico during 1959. The outstanding news was discovery of Mexico's first offshore field by Pauley Pan American Petroleum Inc. in the Bay of Campeche, ½ mile offshore. Initial production from the discovery well was about 772 b/d of 38° API oil from 8,692 ft and 912 b/d from 9,676 ft through a ¼ inch choke. The first stepout was reported better than the discovery well.

South America

Argentina: Union Oil Co. of California brought in its first producing well in Argentina Nov. 8, 1959, on the Peninsula Chica at the southeast corner of Lake Colhue Kuapi in Union's area north of the Rio Chico in the Province of Chubut. The well, P.C.1, bottomed at 4,038 ft and flowed about 625 bbl of 42° oil in a 24-hour test.

Union's first well was given up as a dry hole at 2,783 feet. P.C. 1 was its second under a September 1958 contract with YPF covering two separate areas in the provinces of Chubut and Santa Cruz. Exploratory drilling was begun September 1959. Drilling continues.

YPF announced Sept. 25 it had found gas at 460 meters at R.C.O. 1, 15 kilometers west of Colonial Catriel on the west bank of the Rio Colorado in Rio Negro province. Flow of gas was reported at 60,000 cubic meters a day. YPF said it opens "great prospects" for the area. The well is in the northern neck of the province, about 75 miles north of Neuquen and 65 miles northeast of the Esso contract area.

Saipem, a division of the Italian state oil agency ENI, has started drilling the first of 300 wells it is to drill under contract for YPF. The first well is located in the Meseta Espinosa area of the south flank of Comodoro Rivadavia in Santa Cruz province. Kerr-McGee and Southeastern Drilling, both of which signed contracts to drill 1500 wells in the same area over four years, have not yet begun drilling.

Pan American is also doing a little wildcatting. The company was reported drilling a deep test at Anticlinal Grande projected to basement at about 8,500 ft.

The government has ambitious plans for drilling of about 4,555 wells on the south flank of Comodoro Rivadavia if finances permit.

Bolivia: Gulf Oil is drilling with three rigs in Bolivia. The wells drilling (Dec. 21, 1959) are El Cedro-1 drilling at 14,856 ft 15 miles NW of Santa Cruz; Mitaigua-1 drilling at 12,000 ft 40 miles SE of the Camiri field and Victoria-1 drilling at 4,719 ft 50 miles SE of the Camiri field.

Andes Oil Co. has not begun drilling. Seismic work has been completed and future plans are indefinite.

Chaco Petroleum Co. was drilling Agua Salad 2 at around 12,000 ft in late 1959.

Fish Engineering Co., on the so-called Bolivian Madrejones concession on the Argentine border, spudded two wells. They were around 12,000 ft and 10,000 ft in late 1959, and a discovery was reported.

British Guiana: Offshore seismic work is being done by Standard Oil Co. of California.

Brazil: Effort continues high, with over 5,000 persons employed in the oil search which has gone on for many years without an important commercial discovery. The latest news from Petrobas was encouraging,

however. Referring to the wildcat AM-6-AZ at Autas Mirim, Petrobas announced in January that the arenite layer at a depth of 3,595 ft yielded 1,000 litres of oil during a four-hour formation test.

Greatest activity continues in the Amazon Basin, in the Alagosas-Sergipe area and in the Bahia Reconcavo, the latter being still the only zone producing oil in economic quantities. Exploration has been expanded from Belem in Para to Cruzeiro do Sul in the Acres Territory. Prospecting covers the Upper Solimoes River and its tributaries, the Madeira, Purus and Jurua. Two geological crews are operating in the Tapajos and Japurai river zones, and three are at work in the Moa, Jurua-Mirim, Azul and Purus Valleys, their activities extending to the borders of Peru. Fourteen seismograph teams are operating along the upper reaches of the Amazon River and in the Acre Territory.

In the Maranham Basin geological teams have been prospecting in the State of Piaui, and mapping out the municipality of Imperatriz, bordering on the State of Goias. Seismic crews are operating in the bays of Sao Marcos and Sao Jose.

In the Sergipe-Alagoas Basin, where Brantley Drilling Co., of Texas, contracted to drill 25 wells in 1959, six rigs are operating. Preparations for drilling have been made in the States of Espirito Santo and Rio de Janeiro. In the latter the site selected for the first stratigraphic well, prefixed CST-1, is 42 miles north of Cape Sao Thome, near the city of Campos. In Espirito Santo drilling will start in the municipality of Sao Joao da Barrs.

In the Parana Basin drilling, which had been confined to Sao Paulo and Parana, was extended in 1959 to three other States. In Mato Grosso, Petrobas started drilling in Sitio Sao Domingo, in the municipality of Rio Brilhante. In Rio Grande do Sul rigs have been operating successively at Itacurbi, in the municipality of Santiago, at Guaraxai, near Pelotas, and at Marcelino Ramos, on the Santa Catarina border.

Chile: A number of rigs are running but no discoveries are reported. All exploration is in the hands of the government's ENAP.

Colombia: Ecopetrol - Richfield - Cities Service planned to spud Aguas Claras 5 by mid-January 1960. It is located about 2/3 mile north of No. 4.

At the beginning of 1960, 16 wildcat rigs were active: two belonging to Empresa, three to Texas, two to Colombian Petroleum, one to Shell, two to International, one to Cities Service, one to Nueva Granada, one to Sun Oil, two to John Mecom of Houston and one to Mobil Oil. Ten field rigs were operating, four of them for Texas.

On the Caribbean coast John Mecom is drilling at Tolu jointly with Empresa on a 75-25% basis, and in the Chinu area, south of Conveñas terminal. Sinclair Colombian Oil Co. is drilling on the Santa Rita farmout. Amkirk Petroleum spudded a new wildcat on the Caribbean coast between Baranquilla and Puerto Colombia. Sun Oil of Colombia drilled two dry wildcats in the Sinu basin and has located a new wildcat on the Gulf of Uraba, the most western portion of the Caribbean coast.

In the middle Magdalena valley, Benedum will start drilling in four new concessions, granted to Empresa. Empresa itself drilled an exploration well, Lisama 4, to 15,090 ft. International Petroleum and Sun Oil are drilling in the Provincia block.

Mobil Oil jointly with Shell is drilling a wildcat in the northern llanos, south of the Barinas basin of Venezuela, and about 600 miles distant from the coast, at La Heliera. Cost of the well including previous seismic and gravimetric surveys, transport and location is reported at about $3.5 million. On a promising structure 65 miles east of Bogotá, Texas Petroleum Co. is drilling its wildcat Guavio 1. Transport of rig and material had to be carried out by air, and heavy rains have delayed drilling, which reached reportedly about 1000 ft so far.

Ecuador: Active drilling is being conducted by Tennessee del Ecuador, S.A., a subsidiary of Tennessee Gas Transmission Co. During 1959 Tennessee had two company rigs operating. Four development wells were drilled, all on the Santa Elena Peninsula. Two were completed as producers and two have been suspended pending further evaluation. Five wildcats were drilled, also on the peninsula. Three were in the Engunga concession, ranging from 2,500 to 5,000 ft in depth. One was in Tarapaca and the other is the Atacama block, both ranging from 2,500 to 3,500 ft in depth. All five of these wildcats were abandoned as dry holes.

Tennessee's 1960 plans call for one contract rig and one company rig to operate on the Santa Elena Peninsula and on the Daule concession of approximately 1,500,000 acres. Eight locations have been selected to date, four of them in the Daule area.

Peru: Exploration has slowed nearly to a standstill. The largest company, International Petroleum Co. Ltd., was drilling only one exploratory well in Peru on Jan. 6. The well, designated 1545, is located near the Pacific coastline of northwestern Peru within the so-called Lima Concessions which are operated by International for the joint account of International and Cia. Petrolera Lobitos. Amotape is the only other company drilling, all development work.

Venezuela: Only one seismic party was active at the year's end and 51 rigs running, less than half 1958 activity levels. In the lake, prolific producing wells continue to be found by Phillips, Sun, Superior and the other new concessionaires including Pan American which is staging a comeback after bowing out of one of the world's richest oilfields about 30 years ago.

The Barinas area has had 24 dry wildcats in a row and no one has any appetite for more. Sinclair has an encouraging find at East Agusay which greatly extends this structure.

In the Gulf of Paria, Paria Operations Inc. is getting ready to drill the first of 25 deviated wells from a single platform. Step-outs in the company's offshore area were dry but the company is "far from discouraged." Pan American is getting ready to drill its block in the gulf. Location is only a few miles from the recent finds by Dominion Oil which is rumored to have a very good discovery offshore in Trinidad's waters.

ACTIVE ROTARY RIGS

(January 1, 1960)

Country	Rotaries Active
NORTH AMERICA	
Canada	223
United States (Incl. Alaska)	2,177
CENTRAL AMERICA	
British Honduras	0
Costa Rica	1
Cuba	0
Guatemala	2
Haiti	2
Mexico	118
SOUTH AMERICA	
Argentina	98
Barbados	0
Bolivia	9
Brazil	54
Chile	5
Colombia	28
Ecuador	6
Paraguay	0
Peru	4
Trinided	32
Uruguay	0
Venezuela	51
EUROPE	
Austria	19
British Isles	5
Denmark	0
France	42
Germany	128
Italy (Incl. Sicily)	35
Netherlands	2
Portugal	2
Spain	4
MIDDLE EAST	
Bahrain	1
Egypt	7
Iran	11
Iraq	10
Israel	2
Kuwait	5
Lebanon	0
Neutral Zone	6
Qatar	4
Trucial Coast	1
Saudi Arabia	3
Syria	3
Turkey	7
Jordan	1
Muscat & Oman	3
ASIA & AUSTRALASIA	
Australia	4
Burma	2
British Borneo	3
India	3
Formose	6
Pakistan	4
Japan	15
New Guinea	1
New Caledonia	0
Papua	1
Philippines	3
New Zealand	1
AFRICA	
Algerian Sahara	46
Angola	4
Ivory Coast	1
Ethiopia	0
Gabon	5
Middle Congo	1
Morocco	4
Madagascar	2
Mozambique	0
Nigeria	6
Tunisia	2
Somaliland Protectorate	2
Somalia	2
Senegal	2
Libya	25
WORLD TOTAL	3,254

A Caltex seismic crew builds a tree house for comfortable and safe sleeping in the jungles of Sumatra. Photo by Homer Page for Texaco, Inc.

Phillips Petroleum Co. was drilling two exploratory wells at the end of 1959 as follows: Lake Maracaibo, Lot 17, Parcel Lama 0-11004, Maracaibo Cathedral Coordinates S: 98,806.36 and W: 5,336.21, Well LPG-4-16, drilling ahead.

The other was in Guarico, Bella Vista District, Parcel V-43.4, Barcelona Coordinates N: 177,614.87 and E: 367,960.90, Well Gala 55, drilling ahead.

Wells drilling by Mene Grande were as follows (Dec 15, 1959): Lake Maracaibo, 77-Y-4X, drilling at 14,724 ft. and 11-Y-12, drilling at 14,864 ft; Eastern Venezuela, PaG-2X, Anaco area, drilling at 10,275 ft and RM-19, Anaco area, drilling at 13,145 ft.

Central America And Caribbean

Costa Rica, Guatemala, British Honduras and Trinidad have exploratory wells going; in Panama operations have halted awaiting passage of the new oil law. Nicaragua, Honduras and El Salvador report no activity.

In the Caribbean only Trinidad has any exploratory drilling going on. Cuba has shut down almost completely under the new law with its 60% royalty. Only two cable tools are still running, no rotaries are turning. Following the lead which Cuban Stanolind set some time ago, Gulf Oil Corp. has announced its withdrawal and the rest will not be far behind.

British Honduras: Phillips Petroleum Co. drilled two wells and abandoned both. No wells are drilling now. Sinclair-BP took licenses in 1959 with a minimum requirement of a drilling rig in continuous operation for each 1,000 square miles of license area.

Costa Rica: Only one company is drilling; Union Oil—the operator with Gulf holding 50% interest. On Dec. 21, the company was preparing to abandon Limon 1, a wildcat 1 mile west of Limon. It was spudded Oct. 14, went to 10,189 ft. Telire No. 1 will be drilled in the south of Limon province, near the Panama border.

Guatemala: In the Peten province of Guatemala the Ohio Oil well, called Chinaja, had reached slightly more than 8,500 ft at the end of 1959 but had not reached the 10,000-foot level where Ohio encountered difficulties in the first test. The San Francisco well being drilled by Atlantic was below 5,000 ft with some encouraging shows.

Signal Exploracion de Guatemala is studying location and drilling problems and plans to drill.

Petroleum Investments (Overseas) Ltd. (Shell) spudded in Laguna Blanca No. 1 on May 18, and abandoned it during late 1959 after some gas shows.

Haiti: No drilling is in progress. Cul de Sac 1 well near Port-au-Prince was abandoned dry at 3,772 ft in early 1959 and it satisfied concession requirement for drilling by Commonwealth Oil Co. Other oil companies have contacted Commonwealth and are reported interested in Haiti's oil possibilities.

Trinidad: Exploratory drilling is proceeding, with attention focused offshore. Dominion Oil Co., subsidiary of Standard of California, is drilling from a floating barge in the Gulf of Paria and may have received offshore concessions on the south and east of the island as well. The company has made a discovery in South Domoil 1, drilled in about 93 feet of water 30 miles southwest of Port of Spain and 20 miles north of the Trinidad Northern Areas (Texaco) offshore field. The latter is now being developed by a huge multiple well offshore platform. South Domoil 1 was the fourth wildcat by the company in the gulf. All others were dry.

Onshore, operations are normal. Panoil Co., Dallas, plans to expand its operations in the East San Francique area during 1960, including increased drilling. Panoil has been operating since June under a management contract with Premier Consolidated Oil Fields, Ltd., of London. The East San Francique No. 4, completed at 800-830 feet, flowed 250 barrels of 23-gravity oil in 15 hours through 12/32-inch bean. The well found three other shallow sands, still to be tested. Twelve additional locations have been made for drilling early in 1960. The company holds several thousand acres in the area.

Europe

Austria: RAG (Shell/Mobil) is not drilling any exploratory wells. The government, through OeMV has four seismic crews working and has done some exploratory drilling, both alone and with British Petroleum. OeMV with BP is drilling the Texing wildcat in the Scheibbs concession area. A wildcat by the West German Preussag Co. for Vorarlberger Erdoel was spudded in July in Austria's westernmost province, but no results are announced. No good new discoveries have been made and production is trending steadily downward.

France: Exploratory drilling has taken an upward swing in recent years which shows no signs of abating. A number of lucrative finds were made in the Paris Basin during 1959 (for a summary of these see World Petroleum Report—1960) and efforts are concentrated on that area at present. At the first of the year there were 28 exploratory and 14 development rigs operating in metropolitan France.

Germany: Exploratory drilling is holding up well. As of the end of 1959, Mobil Oil's exploratory drilling operations consisted of three wildcats, all drilling ahead. They were Boostedt—Ost 1, 50 km. north of Hamburg, at 2,400 ft; and Buchhorst Z-2, 50 km south of Bremen, at 10,758 ft.

Italy: Cities Service/Pan American plan to spud Cerignola 1 exploratory test early in 1960, probably by mid-January. It is the first of 7 tests.

Spain: One of the principal explorers is Gulf, drilling in a joint venture with Deilman Bergbau (a German company), 25%, CIEPSA (a Spanish company) 50%, and Gulf 25%. Two wells were drilling on Dec. 15, 1959. Urbasa 1 on the Vitoria concession in the north of Spain was drilling at 6,055 ft. Castillo 1, also in the Vitoria concession, was drilling at 3,580 ft.

Sicily: Gulf is drilling one wildcat, Margherita 1. As of Jan. 1, 1960 it was at 1,518 ft. Location is 37° 02′ N, 14° 52′ E.

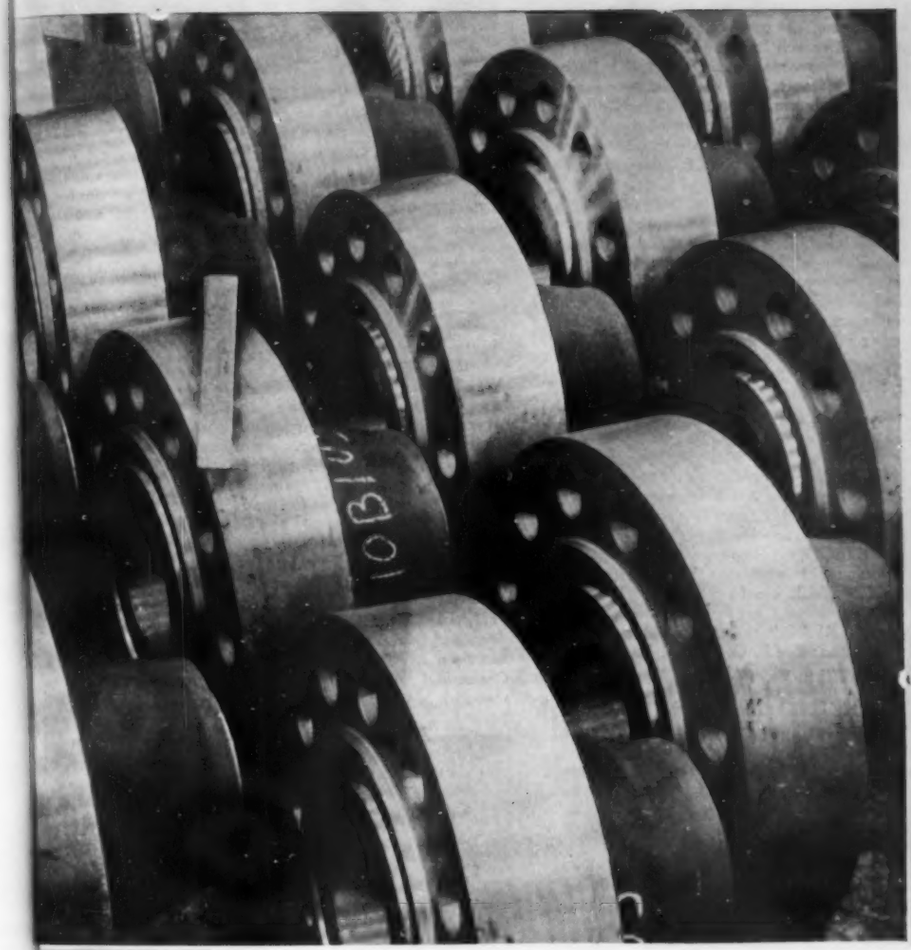
United Kingdom: British Petroleum Co. is the principal explorer. At the year's end one exploratory well was drilling, Winchester 1, at 2,346 feet. One exploratory well was a producer during 1959, Gainsborough 1. During 1960 the company's program calls for drilling two deep tests and starting a third.

Exploration drilling has continued by BP in a number of areas and in the south of England a seismic survey is being made off the Dorset coast as a follow-up to the oil discovery in 1959 on the mainland on Kimmeridge Cliffs. A second rig has been brought in to drill two stepouts to help evaluate the structure. END

TRADE MARK

SOLID FORGED WELDLESS STEEL

Flanges -



TO BRITISH AND AMERICAN STANDARDS

- Welding Neck
- Slip On
- Screwed
- Blind
- Ring Type Joint
- Male and Female Face
- Orifice Type
- Long Neck Nozzles
- Socket Type
- Lapped Joint
- Tema and Large Diameter Flanges
- Plate Flanges
- Square and Rectangular Flanges
- Special purpose Flanges
- for all industries.
- Etc. Etc.

Burton, Delingpole & Co. Ltd.

Old Hill, Staffordshire
ENGLAND.
Telephone: Cradley Heath 69181 P.B.X.
Telegrams: Stampings, Cradley Heath.

London Office: 6, Lygon Place, London, S.W.1. England.
Telephone: SLOane 7294/5
Telegrams: Whitcham, Sowest, London.

OIL COMPANY STAFF CHANGES

Dr. H. L. Malakoff

A. Holden

DR. HOWARD L. MALAKOFF has been elected vice president and general manager of Cities Service Research and Development Co. Since 1956 he has served as manager of the development department of Petroleum Chemicals, Inc., a petrochemicals producer jointly owned by Cities Service and Continental Oil Co. In his new post, he succeeds Lee N. Haugen, who was named vice president and general manager of Cities Service Athabasca, Inc.

HARRY W. DUDLEY, manager of petrochemicals for Delhi-Taylor Oil Corp., has moved to the company's headquarters in Dallas, Texas, from the New York sales office. The line will be expanded to take full advantage of diversified petroleum streams at Delhi's Corpus Christi, Texas, refinery. Albert J. Gnesin will continue as eastern district petrochemical sales manager in New York.

ROBERT L. MINCKLER, senior vice president of the Mobil Oil Co., will retire about the middle of the year. Mr. Minckler was president of General Petroleum Corp. from 1948 until it was merged into its parent company Jan. 1. He has agreed to remain with Mobil Oil until the new organization plan is fully installed on the West Coast and to assist in its implementation.

Mr. Minckler joined General Petroleum in 1924 as an accountant. He was made assistant to the president ten years after joining the company. He was elected a director in 1941, a vice president in 1945, and executive vice president in 1947 and president in 1948.

CARL T. SWAN has been appointed assistant to the vice president of the refinery department of Texaco Inc. with headquarters in New York.

He was formerly assistant superintendent of the company's Lockport, Illinois, refinery. **DAVID K. BEAVON,** assistant supervisor-process in the process and production division in New York succeeds Mr. Swan as assistant superintendent at Lockport.

J. W. HOOD, former supervisor of community relations at the Ohio Oil Co., has been appointed manager of the newly created public relations activities department. He will be responsible for community relations matters and the editorial services function. M. S. Hauser is manager of Ohio Oil's Public Relations Division.

Universal Oil Products Co. has elected **M. D. GILCHRIST, M. R. SCHREIN,** and **R. E. SUTHERLAND,** senior vice presidents. Mr. Gilchrist will be responsible for commercial development, engineering, petrochemical process sales and market research and economics. Mr. Schrein will be responsible for chemical research, manufacturing, chemical products development and product sales. Mr. Sutherland will be responsible for refining research, engineering research and development and company's Riverside, Ill., pilot plant. Each was formerly a vice president.

M. D. Gilchrist

R. E. Sutherland

ARTHUR HOLDEN has been appointed assistant to J. B. Christian, vice president in charge of Trinidad operations in the New York offices of Texaco Inc. Mr. Holden joined Trinidad Leaseholds, Ltd., now Texaco Trinidad, Inc., as a supervisor at the company's refinery at Pointe-a-Pierre, Trinidad. He was made superintendent of the catalytic cracking unit plant there in 1953, assistant refinery superintendent in 1955 and general superintendent (refining) in 1957.

WESTON PAYNE, vice president for production of Anderson-Prichard Oil Corp. retired Feb. 1 after 29 years. He became production manager in 1931 and vice president for production in 1946.

DR. GEORGE H. FANCHER, former graduate professor and chairman of petroleum engineering at The University of Texas, Austin, has been elected vice president in charge of the production research department of Sinclair Research Laboratories, Inc. Bruce F. Grant will be laboratory manager; Dr. Virgil J. Berry, Jr., director of the petroleum engineering research division; James F. Johnson, director of the exploration research division; C. E. Ford, director of the general engineering research division; Dr. Alfred Chatenever, research associate, and Dr. Stephen E. Szasz, research associate.

CLARK A. GRUVER has been appointed assistant manager of Mobil Oil of Canada, Ltd. (Libyan Branch), an affiliate of Mobil International Oil Co. The company headquarters is in Tripoli, Libya. Mr. Gruver joined Mobil in Venezuela in 1939. He held a number of positions in both Venezuela and Colombia before becoming manager of services for Mobil Oil de Venezuela in 1958.

PAUL J. JAYE has been appointed Application Engineer, Export Division, Selas Corp. of America, Dresher, Pa.

HAROLD D. HOOPMAN, operations manager of The Ohio Oil Co. of Guatemala, has been appointed resident manager succeeding J. Potrick D'Artois, who died late in October. In another personnel change, **ARTHUR H. PETSCH,** exploration manager for Ohio Oil of Guatemala, will retire and be succeeded by **CLARK M. SHIMEALL,** chief geologist.

WILLIAM I. PATRICK has been elected president of Esso S.A.P.A. succeeding **B. G. TCHALIDY** who is retiring after 37 years of service in Argentina.

LAWRENCE L. SMITH has been appointed general manager-manufacturing of Amoco Chemicals Corp. He continues as a director, a position he has held since Amoco Chemicals was formed in 1957. For the past year Mr. Smith has been on a special assignment in connection with the formation of Amoco Fina S.A. by Amoco Chemicals Corp. and Petrofina S.A. of Belgium. He will continue as a director of Amoco Fina.

ARTHUR L. LANCKTON has been appointed an executive vice president of Mobil International Oil Co. He has been vice president in charge of northern and southeastern Europe. He has been with Mobil's international operations since 1938.

Announced at the same time were the following appointments: Rawleigh Warner, Jr., as acting executive vice president—Africa, Europe, and Latin America. John C. Dean as vice president, supply and distribution; Burton C. Fowler, as vice president, marketing; Charles P. Baker, as vice president, Northern and Southeastern Europe; William E. Lindemuth, as acting regional vice president, Middle East.

M. R. Schrein

A. L. Lanckton

GORDON M. MACE, JR., has been elected a vice president of Independent Exploration Co. He resigned as president of Marine Exploration Co. to join Independent when Independent bought out the geophysical operations of the Marine Co.

His career in the field of geophysics started with Petty Geophysical Engineering Co. in 1939 taking him to Sumatra, Dutch East Indies, and Colombia, South America. With this organization and three others he searched for oil in 17 states in 20 years.

Dr. Franklin Veatch

G. M. Mace, Jr.

DR. FRANKLIN VEATCH has been promoted to the newly-created position of research director (in charge of petrochemicals, polymers and new processes) at the Sohio Research Center in Warrensville Heights, Ohio.

Dr. Veatch has been with Sohio's research since 1942. He has recently guided the research on acrylonitrile which Sohio is now commercializing in a 50 million lb/year plant at Lima, Ohio.

JOHN F. CURRAN, senior attorney at Sunray Mid-Continent Oil Co. and former Superior Court judge at Enid, Okla., has been named assistant general attorney for the company. He has been an attorney for Sunray since 1952.

WILLIAM A. SULLENDER is the new general manager of distribution for the American Oil Co. in an organizational realignment that places all terminal activities under American's supply and transportation department. He has assumed direction of the company's 14 deep-water terminals, three large river asphalt terminals, and more than 50 other barge and pipeline terminals.

Assistant managers reporting to Rodgers are J. D. Nitzschke, barge and pipeline terminals; W. E. Erwin, ocean terminals; and R. E. Looby, truck transportation.

WILLIAM M. COCKE has been elected vice president and general manager of Cit-Con Oil Corp. He has been assistant general manager since 1950. Mr. Cocke first joined Cit-Con in 1947, prior to which he was with Marland Oil Co. and Continental Oil Co.

W. M. Cocke

H. Book

HOWARD BOOK, senior vice president of Reed Roller Bit Co., retired after 31 years with the company. He was eligible for retirement June 1, 1959, but continued in an active capacity on request.

Mr. Book will be retained by Reed in a consulting capacity, and also plans to open an office in Houston as a Foreign Trade Consultant specializing in foreign oil tool sales, manufacturing, and licensing agreements for American firms. Being directly in charge of Reed's foreign sales for the past 20 years, he has gained innumerable valuable contacts and has acquired a singular knowledge in this highly specialized field.

Mr. Book served Reed as field salesman in the U. S. and Canada, manager of Mid-Continent operations; manager of Eastern Hemisphere operations in London, export manager in New York, vice president in charge of sales, and senior vice president.

He was charter member of the New York Chapter of the NOMADS, having served that organization as vice president, president, and as a Regent of the national organization.

SSC HAS WHAT IT TAKES TO FIND OIL . . . ANYWHERE!

Modern Field Equipment, Experienced Field Crews, for Economical Prospecting

Seismic Replay Center for More Informative Interpretations

Magnetic Tape Conversion for Greater Versatility in Exploration

Data Plotting for More Realistic Data Presentation

Management with World-Wide Experience and Background for Reliable Results

Seismic Recording Instruments for Effective Prospecting

Analog Computing for More Significant Gravity Surveys

WORLD-WIDE EXPERIENCE ON ALL CONTINENTS

Seiscor Manufacturing Company Division Integrated Engineering and Manufacturing

Birdwell Division Complete Wireline Services — When & Where Needed

THESE SERVICES AVAILABLE FOR YOUR USE NOW

CALL OR WRITE . . .

SEISMIC — GRAVITY AND MAGNETIC SURVEYS — LORAC — CONTINUOUS VELOCITY LOGGING

Seismograph Service Corporation

P. O. Box 1590 • TULSA, OKLAHOMA • Riverside 3-1381

WORLD-WIDE SUBSIDIARIES

SSC of Argentina • SSC of Bolivia • SSC of Canada • SSC of Colombia • SSC International • SSC of Libya • SSC of Mexico SSC of Venezuela • Seismograph Service Limited—England • Seismograph Service Italiana Compagnie Française de Prospection Sismique

E. D. Brockett

W. O. Jacobs

E. D. BROCKETT has been elected executive vice president of Gulf Oil Corp. He has been president of The British American Oil Co. Ltd., in Toronto, since April 17, 1958.

Mr. Brockett joined Gulf in 1934 as a roustabout in West Texas. In 1952 he was appointed assistant to the president of the Mene Grande Oil Co., Gulf's Venezuelan subsidiary, and later became manager of production operations for this company in Eastern Venezuela. He was elected a vice president of Gulf in 1955, and two years later was made coordinator of production operations on a world-wide basis. The following April, he was elected a director, president and chief executive officer of British-American.

WILLIAM O. JACOBS has been appointed western sales representative by The M. W. Kellogg Company, New York. His offices are in Los Angeles at 727 West 7th St.

CARL W. VIRGIN, a veteran of 23 years in plastics research, product development and marketing, has been named marketing coordinator—plastics for the Enjay Company, Inc.

JOHN J. WINTERBOTTOM, a vice president of Esso Standard, has retired after more than 43 years' service with Standard Oil Co. (N.J.) and its affiliated companies. He is one of the top authorities on marine transportation in the Jersey Standard organization.

Before his election in 1958 as a vice president and director of Esso Standard, Mr. Winterbottom headed Jersey Standard's transportation coordination department for six years, with responsibility for Jersey's world-wide transportation activities. Earlier, he was executive vice president of the Esso Shipping Company, now part of Esso Standard.

ARTHUR W. MOHR retired February 1 from the presidency of California Spray-Chemical Corp., subsidiary of Standard Oil Co. of Calif. He also leaves the post of vice president of California Chemical Co., parent management organization for Calspray and Oronite Chemical Company.

MAURICE MARTIN has been named executive vice president of GEOPETROLE of Paris, a consulting firm specializing in formation evaluation and reservois engineering. He formerly was manager of operations for Societe de Prospection Electrique (Paris), and for 11 years was head of the publication and interpretation department at Schlumberger's research center in Ridgefield, Conn.

JOHN J. NILAND has been made assistant engineering manager, Stone & Webster Engineering Corp.

L. E. SAVORY, project supervisor at the United Gas Corp. research laboratory since 1953, has been named assistant director of research for United Gas at Shreveport, La.

A. RUSSELL YOUNG has been appointed assistant executive vice president and general manager of J. F. Pritchard and Co., Kansas City, Mo. Mr. Young is also vice president of the Constock-Pritchard Liquefaction Corp. formed to develop the design and construction of plants and facilities for all phases of Natural Gas liquefaction.

C. HAYDEN ATCHISON, formerly division manager of exploration for The British-American Oil Producing Co.'s southwestern division in Midland, Texas, has been promoted to exploration coordinator at Dallas. He succeeds R. C. Marmaduke, resigned.

FRED C. BRECHTEL, vice president, Geophoto Services, Ltd., Calgary, has been elected executive vice president and a director of Geophoto Services, Inc. Mr. Bretchtel has been with Geophoto Services since 1949 and in Calgary since 1954. Jerald Alliger has been named vice president and a director of Geophoto Services, Inc., Denver. Mr. Alliger joined Geophoto in 1946.

RAYMOND A. REINKE, Amarillo, Texas, has been promoted to vice president in charge of Continental Carbon Co.'s international division. He was formerly manager of commercial development headquarters in Amarillo.

L. C. STEVENS has been named division vice president for exploration and producing of the Los Angeles division, Mobil Oil Co. He will establish an exploration and producing organization in Los Angeles patterned after the Mobil divisions recently created in Denver, Colo., Houston and Midland, Texas. Mr. Stevens was formerly a director, vice president and manager of production of Mobil Oil Canada, Ltd., of Calgary.

NORMAN JAQUES, vice president and sales manager of Driltrol of Long Beach, Calif., has returned from an extended tour of the oilfields in Trinidad, Venezuela, Colombia, and Mexico.

CAPT. ROBERT A. SMITH, (USCG Ret.) has been named to succeed Vance N. Jenkins as coordinator of the tanker corrosion research project, of the division of transportation of the American Petroleum Institute.

Mr. Jenkins who retired on Jan. 1 had been on leave of absence from Union Oil Co. of California for the past three years.

ROY M. MAYS, Fort Worth, Texas, has been promoted to director of reserves and production acquisitions for Continental Oil Co., Houston. He was formerly assistant general manager of Conoco's southwestern region. He succeeds K. W. Brill, who recently transferred from New York City to Denver, Colo., as vice president and assistant general manager of Conoco's Rocky Mountain region.

to find it out...

Compagnie Générale de Géophysique

50 rue Fabert Paris 7e

World Petroleum Statistics

FREE WORLD SUPPLY AND DEMAND, CRUDE AND PRODUCTS, JUNE 1959

(Thousands of barrels)

Source: USA Bureau of Mines, Division of Petroleum.

Country	CRUDE PETROLEUM					REFINED PRODUCTS			
	Production	Imports	Exports and reexports	Stock change, other demand, and loss	Total 1/ refinery input / Total 2/ refinery output	Imports	Exports and reexports	Apparent domestic demand (incl. bunkers)	Bunkers-all flags (as reported)
NORTH AMERICA									
Canada	14,916	9,689	4,225	-1,568	22,217	2,335	79	3/22,545	
Mexico	7,809	-	-	-329	8,750	703	843	8,610	
United States (incl. Alaska)	212,489	36,147	192	+8,837	256,628	20,919	7,600	3/274,298	6,743
Subtotal	235,214	45,836	4,417	+6,940	287,595	23,957	8,522	305,453	
CENTRAL AMERICA AND CARIBBEAN									
Costa Rica	-	-	-	-	-	E/113	-	113	
Cuba	16	2,296	-	-170	2,482	E/366	-	2,848	
Dominican Republic	-	-	-	-	-	E/165	-	165	
El Salvador	-	-	-	-	-	E/140	-	140	
Guatemala	-	-	-	-	-	E/249	-	249	
Haiti	-	-	-	-	-	E/49	-	49	
Jamaica	-	-	-	-	-	568	-	568	
Nicaragua	-	-	-	-	-	E/90	-	90	
Panama, Canal Zone	-	-	-	-	-	E/559	E/173	386	E/384
Panama, Republic	-	-	-	-	-	E/173	-	173	
Puerto Rico	-	2,796	-	+367	3,521	643	994	2,170	
Subtotal	16	5,092	-	+197	5,003	3,115	1,167	6,951	
SOUTH AMERICA									
Argentina	3,507	3,058	-	+683	5,962	2,018	-	3/8,200	119
Bolivia	271	-	63	+18	190	8	2	196	
Brazil	2,067	3,089	1,189	-823	4,790	E/1,624	-	6,414	
Chile	517	203	-	+246	474	E/595	-	1,069	
Colombia	4,441	-	2,458	+39	2,007	-	339	3/1,502	
Ecuador	224	-	-	-6	230	108	-	338	
Netherlands Antilles	-	18,662	-	+101	19,392	E/2,381	E/17,167	4,606	
Paraguay	-	-	-	-	-	E/48	-	48	
Peru	1,458	-	261	-77	1,291	-	235	1,056	84
Trinidad	3,384	2,771	642	-272	5,824	E/25	E/3,002	2,847	895
Uruguay	-	651	-	+17	634	838	-	872	
Venezuela	84,669	-	60,252	+1,439	82,978	E/47	18,884	3/3,897	1,357
Subtotal	100,618	28,434	61,865	+1,365	63,772	7,098	39,629	31,045	
WESTERN EUROPE									
Austria	1,392	E/300	868	-229	1,091	670	156	1,605	
Belgium and Luxembourg	-	1,930	-	+316	3,650	1,007	1,522	3,135	
Denmark	-	98	-	+65	27	1,880	13	1,894	160
Finland	-	593	-	-7	E/600	349	-	949	
France	963	15,353	-	-815	17,141	1,174	3,340	14,975	
Germany, West	1,080	9,298	-	-956	13,328	2,657	1,461	14,524	
Greece	-	562	-	+8	554	324	-	878	
Iceland	-	-	-	-	-	190	-	190	
Ireland	-	477	-	+477	-	485	-	485	
Italy	982	14,199	122	+768	14,347	524	4,734	10,137	
Netherlands	1,011	10,482	-	+2,598	9,657	3,325	5,804	7,778	598
Norway	-	48	-	-11	59	1,834	-	1,893	
Portugal	-	845	-	-98	865	243	63	1,045	
Spain	-	1,830	-	-424	2,380	128	-	2,448	
Sweden	-	1,523	-	+223	E/1,300	4,421	75	5,646	
Switzerland	-	-	-	-	-	2,507	3	2,504	
United Kingdom	44	23,636	-	+311	23,369	8,569	3,905	3/23,952	2,504
Yugoslavia	345	E/409	-	-	754	E/50	E/151	653	
Subtotal	7,817	83,581	1,010	+2,304	89,062	30,337	20,707	94,691	
MIDDLE EAST									
Aden	-	3,134	-	+312	2,822	360	1,104	2,078	1,666
Bahrain	1,355	3,584	-	+96	4,783	-	4,089	694	342
Iran	28,468	-	16,317	+1,080	E/11,071	-	6,939	4,132	
Iraq	24,619	-	E/23,419	-	E/1,200	E/-	-	1,200	
Israel	60	E/790	-	-	E/850	E/297	-	1,147	
Jordan	-	-	-	-	-	88	-	88	
Kuwait	38,042	-	33,737	+212	4,093	16	2,312	1,797	1,514
Lebanon	-	453	-	-	E/453	23	E/-	476	
Neutral Zone	3,580	-	E/2,900	-320	E/1,000	E/-	E/790	210	
Qatar	5,019	-	E/5,003	-	E/16	-	-	16	
Saudi Arabia	32,545	-	25,306	+1,266	5,973	4	3,416	2,561	
Turkey	235	-	-	+14	221	630	-	851	
U.A.R., Syria	-	-	-	-	-	243	-	243	
Subtotal	133,923	7,901	106,682	+2,660	32,482	1,661	18,650	15,493	
AFRICA									
Algeria	577	-	E/353	+224	-	695	-	3/536	
Angola	28	-	-	+3	25	72	-	97	
Belgian Congo	-	-	-	-	-	249	-	249	
Canary Islands	-	1,796	-	+147	1,850	89	1,252	687	473
Ethiopia	-	-	-	-	-	E/94	-	94	
States formerly in French Equatorial Africa	449	-	449	-	-	E/80	-	80	
French West Africa	-	-	-	-	-	E/339	-	339	
Ghana	-	-	-	-	-	E/226	-	226	
Kenya	-	-	-	-	-	335	94	241	
Liberia	-	-	-	-	-	E/32	-	32	
Madagascar	-	-	-	-	-	E/51	-	51	
Morocco	57	E/100	-	+35	122	326	-	448	
Nigeria	270	-	270	-	-	442	-	442	
Rhodesia & Nyasaland	-	-	-	-	-	E/316	-	316	
Sudan	-	-	-	-	-	275	-	275	
Tanganyika	-	-	-	-	-	120	32	88	
Tunisia	-	-	-	-	-	297	-	3/261	
Uganda	-	-	-	-	-	98	15	83	
Union of South Africa	-	649	-	-161	810	1,444	197	2,057	
U.A.R., Egypt	1,752	E/900	484	+268	E/1,900	E/260	-	2,160	
Subtotal	3,133	3,445	1,556	+516	4,707	5,840	1,590	8,762	
SOUTH ASIA, FAR EAST, AND OCEANIA									
Australia	-	5,862	-	-78	6,017	808	559	6,266	E/582
British Borneo	3,420	-	1,935	+135	E/1,350	73	E/1,382	101	
Burma	319	-	-	+28	291	E/28	-	319	
Ceylon	-	-	-	-	-	522	-	522	
India	255	E/2,752	-	-	E/3,007	3,636	26	6,617	
Indonesia	11,103	E/1,429	5,578	-	E/7,434	E/358	E/3,119	4,673	E/161
Japan	231	11,756	-	+429	11,558	2,041	206	13,393	
Korea, South	-	-	-	-	-	89	-	89	
Malaya and Singapore	-	585	429	+156	-	2,508	1,586	922	
Netherlands New Guinea	130	-	E/130	-	-	-	-	-	
New Caledonia	-	-	-	-	-	E/31	-	31	
New Zealand	-	-	-	-	-	785	-	785	
Pakistan	185	-	-	+16	169	E/1,070	-	1,239	
Philippines	-	664	-	-129	793	E/562	2	1,353	
Taiwan	1	683	-	+4	680	5	-	625	
Thailand	-	-	-	-	-	867	37	830	3
Vietnam, South (incl. Cambodia)	-	-	-	-	-	E/272	-	272	
Subtotal	15,644	23,671	8,072	+561	31,239	12,995	6,857	37,377	
WORLD TOTAL EXCLUDING EASTERN EUROPE, U.S.S.R., & MAINLAND CHINA	496,385	197,960	186,602	+14,543	513,860	84,997	97,122	499,772	

E/ Estimate based on latest available data.
1/ Total input includes crude runs to stills plus runs of other unfinished oils, topped crude and natural gas liquids blended.
2/ Total output includes refined product output plus refinery fuel and loss.
3/ Domestic demand as reported, including stock changes.

FRANCIS BOYER, chairman of the board of Smith, Kline & French Laboratories has been elected a director of Atlantic Refining Co. to serve the unexpired term of Henning W. Prentis, Jr., who died in October, 1959.

BYRON K. SMITH, formerly assistant general manager of Southern Pacific Pipe Lines, Inc., has been appointed assistant to president D. J. McGannay, with headquarters at San Francisco. He was succeeded by William T. Eskew, Jr., formerly chief engineer.

BRYSON FILBERT has been appointed chemical products advisor to the refining coordination department of Standard Oil Co. (N.J.). He was formerly manager of manufacturing in Bogota for International Petroleum (Colombia) Ltd. Mr. Filbert joined Humble Oil & Refining Co. at the Baytown refinery in 1936 and was made assistant division head of research and development at Baytown in 1947. He was transferred to International at Coral Gables in 1956.

D. C. BRELAND has joined Petreco division of Petrolite Corp. at Houston. His work will pertain to chemical and electrical dehydration and other Petreco electric treating processes and equipment. Mr. Breland had six years experience in Venezuela with Mene Grande Oil Co. where he was concerned with oil production and dehydration.

LEWIS A. LAPHAM and **ALBERT L. WILLIAMS** have been elected directors of the Socony Mobil Oil Co., Inc. Mr. Lapham is chairman of the executive committee of the Bankers Trust Co., New York. Mr. Williams is executive vice president and a director of International Business Machines Corp., New York.

J. A. BOEGE has been named manager of technical services at Mobil Oil Co. refinery at Torrance, Calif. J. W. Jensen was named chief project engineer at the refinery.

WILLIAM D. BASKETT, JR., has been elected president of Frontier Oil Refining Co., Buffalo, N. Y. He was formerly executive vice president. Mr. Baskett was initially employed by Allied Oil Co., Inc., Cleveland, Ohio, in 1942. While employed by Allied he served on the Petroleum Industry Committee in District 2 of the Petroleum Administration for War, and following the merger of Allied with Ashland Oil in 1948 he became executive assistant to the management of Allied. He assumed similar duties at Frontier in 1951 and was named executive vice president of Frontier in 1952.

FRANK C. COLEGROVE has been elected president and **JOHN G. CLYMER** a vice president of Allied Oil Co., Cleveland, Ohio. He was formerly executive vice president of Allied.

JAMES ROSS has been appointed West Coast regional manager of purchases of the Mobil Oil Co., with headquarters in Los Angeles. He succeeds P. J. Whiteley who has retired after 40 years of service with General Petroleum Corp., as manager of purchases. E. W. Millaird has been appointed senior buyer.

LOUIS H. HUTH has been appointed to the newly created position of manager of operations of Amoco Chemicals Corp. and will be in charge of the company's plants at Joliet, Illinois; Texas City, Texas; and Seymour, Indiana. **FRANK ALLEN UPSON** has been appointed manager of engineering, a second new position, and will assume responsibility for engineering and construction of new plant facilities and other major projects.

The invention of a new type of grease has earned **ARNOLD J. MORWAY** of Esso Research and Engineering, Linden, N. J., his 200th U. S. patent and a position as one of the nation's most prolific inventors. The record is unexcelled in the 40-year history of the company.

Mr. Morway's 200th patent opens up possible new applications for an already highly-versatile grease (known as Nebula EP), widely used in industrial and automotive applications. It eliminates the necessity of adding special materials to resist severe pressures in the teeth of gears. It is expected to be particularly applicable to the steel and other metal-rolling industries and in mining machinery.

Many of Mr. Morway's inventions have been successfully used in the manufacture of new-type lubricants and greases. He has been with the company 30 years and was issued his first patent in 1939.

"He said to use Milwhite...
we like the service
and the men in the field
do too..."
Next time join
the Trend to Milwhite and
enjoy more Drilling
Benefits*
*Milwhite Drilling Benefits:
New Products, More Research, Comprehensive
Communications, Highly Trained Engineers, a new
Stockpoint Building Program and a Real Mud Service
the industry has needed for a long time.
MILWHITE
MUD SALES COMPANY
HOUSTON, TEXAS
DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION

CANADIAN NOTES

Close up of the mining wheel in operation at Mildred Lake, in northeastern Alberta Province, Canada where Imperial, Richfield, Cities Service and Royalite are conducting pilot plant studies to determine the commercial feasibility of extracting hydrocarbons from the Athabasca oil sands. Six buckets fastened to the wheel dig into the mining face and drop their load upon a conveyor belt, which transfers the oil sand to the extraction unit.

Tar Sands Project Expanded

A comprehensive research project to release liquid hydrocarbons from the Athabasca oil sands of northern Alberta was announced in January, along with the formation of a four-company partnership to carry forward the enterprise.

The four companies are Imperial Oil Ltd., Cities Service Athabasca, Inc., a subsidiary of Cities Service Co., which will operate the project, Richfield Oil Corp. of Los Angeles, and Royalite Oil Company, Ltd. The first three will each hold a 30% interest in the partnership, Royalite will hold 10%.

The Athabasca oil sands some 300 miles north of Edmonton along the Athabasca River comprise the world's largest known reserves of hydrocarbons. Areas in which these sands are at or near the surface contain in excess of 40 billion bbls of recoverable oil, about the same as the proved crude reserves of North America. In other areas, the sands, deeper under the surface and with varying depths of overburden, contain vast additional reserves.

Research activities have been carried on individually by the partners for several years, searching for a method of extraction of oil from the Athabasca sands on a commercially feasible basis. The present program was begun two years ago by Cities Service. Subsequently, a $3,500,000 pilot plant was built at Mildred Lake, about 30 miles north of McMurray.

The plant includes a 3,000 b/d distillation unit, extensive separation equipment and numerous collateral facilities. A unique mining "wheel," which has proved highly successful in the surface mining of coal in Europe, strips the sand from the surface.

As operator of the project, Cities Service Athabasca, Inc., has established headquarters in Edmonton. President is A. P. Frame, senior vice-president of Cities Service Co. Lee N. Haugen, for many years a Cities Service executive in refinery construction and operation and recently vice-president in charge of research, will be vice-president and general manager, with headquarters in Mildred Lake and Edmonton.

In September 1958, work was begun on design for a pilot plant at Mildred Lake. This plant went into operation in August 1959. Richfield joined the project in December 1958 and Imperial entered the partnership in October 1959.

The average hydrocarbon content of the deposit is about 10 wt-%. The hydrocarbons are approximately 7.5 API gravity and solid at atmospheric temperature. About 50% of the hydrocarbon boils below 1,000 F. The sulfur content is about 5%, with vanadium running about 300 parts per million.

Economic studies indicated that a commercially attractive venture would require large-scale mining operations. The Athabasca' group's executive engineers scoured both the USA and Europe for suitable mining machinery. They found the most promising device in use in the Ruhr Valley, where German fabricators had engineered and built gigantic mining wheels for the commercial exploitation of brown coal.

Buckets fastened to a huge wheel dig into the mining face, and drop their load upon a conveyor belt, which transfers it, in the case of the tar sands, to an extraction unit.

The sequence of operations is as follows: The bituminous sands are delivered by the belt conveyor from the bucket wheel to the extraction unit. Here the first step consists of separating rocks and foreign material. The second and basic extraction process consists of using a diluent—produced from the bitumen itself—to reduce the viscosity and specific gravity of the bitumen. Water is then added, causing the sand to precipitate, freeing the diluted bitumen for subsequent processing. The precipitated, oil-free sand is discharged to the escarpment area.

Leaving the extraction unit, the mixture of water, diluent and bitumen passes through a separation plant. The oily mixture is decanted from the water.

The water is recycled to the extraction unit, and a small quantity of make up water is added. Flow and temperature of the recycle water is controlled by the separation unit operator, while the temperature of the make up water is regulated automatically by means of 100 psi steam injection.

The diluent recovery unit, which then separates the bitumen from the diluent, has been designed to process 3,000 b/d of a mixture of 67% diluent and 33% bitumen by volume. Diluent is recovered by heating in a furnace and flashing at high temperature and at atmospheric pressure.

The diluent is returned to the extraction process, while the virgin bitumen is split into two streams, one to storage for subsequent use as fuel, the other to a visbreaking unit which is actually a simplified thermal cracking unit. The unit was prefabricated by M. W. Kellogg Co., and shipped to Mildred Lake.

The bitumen passes successively through two oil-fired furnaces. The effluent is quenched in a soaking drum, then collected in a receiver, from which the tail gas is vented to a flare.

Some coke is unavoidably formed in the furnaces and the soaker drum. It must be spalled and burned, with the help of steam and air, as part of a regular schedule.

The net liquid is pumped from the receiver drum as the final product.

Temperatures and pressures, as well as proportions of recycled fluids, must be carefully controlled in this visbreaking operation.

Products emerging from the combination diluent recovery and visbreaking units are finally: diluent, overhead naphtha, bitumen, and visbreaker liquid.

The furnace of the diluent recovery unit and the two visbreaker furnaces are of the single upfired helical coil oil-burning type.

Based on bench scale results and engineering estimates to date, Athabasca researchers believe that it should be possible to design facilities to separate the bitumen at a reasonable cost.

Should pilot plant studies substantiate this estimate, the major hurdles are still to come. For the extracted bitumen, in itself, is certainly no conventional article of commerce. This bitumen, as mentioned earlier, is solid at atmospheric temperatures.

Because of its high sulfur content, it is probable that hydrogenation is the only possible way to convert the bitumen to a low-sulfur crude oil. In this connection, the Athabasca group has been conducting intensive hydrogenation experimental work.

In addition to the possibility of converting this material to a satisfactory crude oil, the Athabasca group believes that modern technology should permit the economic recovery and transportation of these hydrocarbons as a fuel oil for any fuel-short Canadian areas.

T-N Gets New Chief Executive

Glynne J. Evans of Edmonton has been elected vice-president and general manager of Trans-Northern Pipe Line Co., Toronto. He succeeds L. R. Dickinson who retired as president Jan. 31, because of ill health. The 450-mile product pipeline between Montreal and Hamilton is owned by The British American Oil Co. Ltd., Texaco Canada Ltd., and Shell Oil Co. of Canada Ltd.

Mr. Evans began his pipeline career as a field engineer with Imperial Pipe Line Co. Ltd. In 1952 he joined Texaco Exploration Co. as a pipeline superintendent, the position which he leaves to take over his new post as head of Trans-Northern.

G. J. Evans

J. A. Groves

Groves Joins Mission

James A. Groves has joined Mission Manufacturing Co. as sales representative for the Edmonton, Alberta. He formerly served with the Oilwell Supply Co. for 11 years. He has been a resident of Canada for the past five years.

Decalta Drills In Arctic

Western Decalta Petroleum Ltd. as operator on behalf of a group of independents, has spudded the first of a series of wells to be drilled north of the Arctic Circle. The first well is 40 miles north of the Circle.

The group of independents includes Canpet Exploration Ltd., New Continental Oil Company of Canada Ltd., Glacier Explorers Ltd., and Supertest Petroleum Corporation, Ltd.

The announcement stated that Decalta et al Rond Lake #1 is situated near the largest natural oil seepage so far found north of Norman Wells.

"The location is about one mile down dip from the seepage and prospects for oil are in Devonian reef similar to the Norman Wells development," the company added.

Drilling equipment belonging to Big Indian Drilling Co. was barged down the Mackenzie River about 700 miles from Hay River to Fort Good Hope before freeze-up. A depot was made 16 miles north of Fort Good Hope. A 54-mile bush road was then constructed from the depot to the site at Rond Lake and the equipment was moved in by "cat train" before Christmas.

A. E. Ames & Co.

Limited

Government, Municipal

and Corporation Securities

A. E. Ames & Co.

Members

Toronto Stock Exchange

Montreal Stock Exchange

Canadian Stock Exchange

United States Affiliate:

A. E. Ames & Co. Incorporated

New York • Boston

Business Established 1889

Toronto

MONTREAL LONDON, ENG. VANCOUVER VICTORIA
WINNIPEG CALGARY LONDON HAMILTON OTTAWA
KITCHENER ST. CATHARINES OWEN SOUND QUEBEC

FARGO
DODGE
DE SOTO

4-wheel-drive pioneers

Take To Sand, Mud Or Hillsides

Here's more action, stamina and advanced engineering than has ever been combined before! Fargo - De Soto - Dodge 4-wheel-drive pulling power takes swift care of demanding off-road jobs with no strain... yet offers smooth, easy-handling performance down the highway. Choose from a full line of models and capacities: W100 with max. G.V.W. 6,000 lbs.; W200 - 8,000 lbs.; W300 - 10,000 lbs.; the original WM300 Power Wagon - 9,500 lbs.; and the mighty W500 (available with heavy-duty sand tires) - 20,000 lbs. Pick-up models W100, W200, W300, WM300... W100 Town Wagon.
Job-Rated 6-cylinder and V-8 engines... wheelbases ranging from 108" to 117". Power take-off available for operating field equipment.

CHRYSLER INTERNATIONAL S.A.

GENEVA - SWITZERLAND

PUBLICONTINENTAL CISA - P. FL. - 4 - 4.

Killing Three Birds

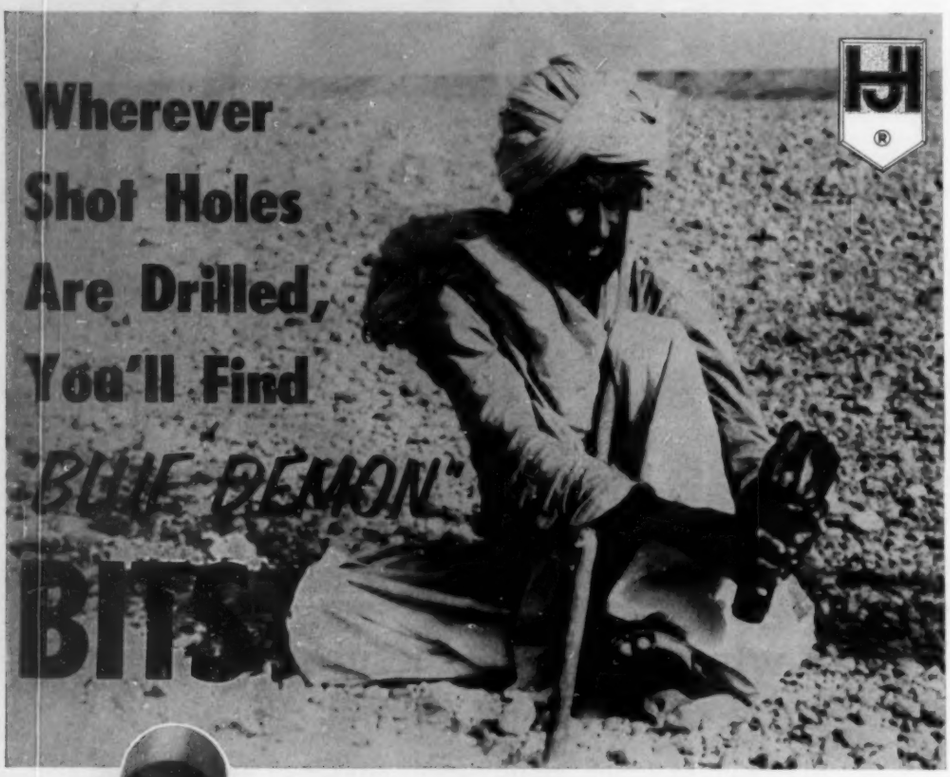
(*Continued from page 45*)

more intimately presents the relationship between velocity and lithology than any other form of measurement. It follows that the accumulation of geophysical log data should be an important step in the solution of problems connected with the stratigraphic accumulation of hydrocarbons. As the connection between the geophysical log and the wave form on regular field seismograph records is investigated, valuable data concerning reflection coefficients, identification of multiple and/or ghost reflections, and other phases of the study of record quality should result. The synthesis of seismic records from geophysical log information offers perhaps one of the most challenging and rewarding new exploration techniques.

Closely spaced and accurate seismic-sonic control from wells drilled in any area becomes more and more important as the geophysicist in the United States is required to extend his search for ever smaller and lower relief structures. Undoubtedly, too, significant reserves of oil and gas in stratigraphic traps remain to be found. Geophysical log studies offer the possibility of developing techniques needed to utilize economically seismic prospecting in the search for stratigraphic traps.

Field seismic data acquired in prior years requires constant reworking in the light of additional seismic-sonic control. A carefully planned program of also acquiring geophysical information from each sonic log run might well prove to be one of the cheapest and most effective phases of a total exploration program possible. The revision and reanalysis of work now existing in many exploration department files alone would easily justify the relatively small additional cost of taking seismic check shots on sonic logs run in drilling wells.

Whether a geologist is using the sonic log for lithology and correlation studies, an engineer is using the log for reservoir analysis, or a geophysicist is using the log for seismic interpretation, it is obvious that killing three birds with one stone has a practical and economic appeal. A sonic log with geophysical check shots does just that. Petrophysical and geophysical information of significance is developed for the geologist, the geophysicist and the engineer. END



With the problems of shot hole drilling pretty much the same the whole world over, it takes a bit that's as rough and tough in Tunis or Alberta . . . as in Texas or the Argentine . . . which will provide the most efficient performance at an economical per-foot cost.

Patented Hawthorne "Blue Demon" Bits have proven inherently better for international operations because:

- Basically high quality of original design and manufacture assures superior performance every time . . . at consistently competitive price . . .
- Replaceable blade feature provides factory-controlled "on-the-drill" bit service ANYWHERE . . .
- Interchangeability of size and formation-type of blades in the same bit body tremendously increases bit versatility . . . reduces inventory needs . . .
- Vastly reduced bulk and weight requirements over competitive products offer additional savings in handling, shipping and storage costs . . .

Available in popular fractional sizes to fit all types of shot hole drills.

WRITE FOR ILLUSTRATED CATALOG

U.S. Patent Nos.
2,615,684
2,666,622
2,695,158
2,783,973
2,831,657
2,859,942
2,890,020

HERB J. HAWTHORNE INC.

Cable Address: HAWBIT • P. O. Box 7366 • Houston 8, Texas

NEW PUBLICATIONS

Integration and Competition in the Petroleum Industry, by Melvin G. de Chazeau and Alfred E. Kahn. This new book represents an attempt to assess rather than to explain the effect of the gigantic size and integrated structure of the major U.S.A. petroleum companies on the effectiveness of the industry's competitive performance at each level of its operations. The authors explain the extreme degree of integration in the industry in terms of its technology and of the historical occasions for the evolution of this form of organization.

This is Volume 3 in the Petroleum Monograph Series, being published by the Yale University Press by means of funds supplied by outright gift by the American Petroleum Institute. Both authors are at Cornell University: Mr. de Chazeau is professor in the Graduate School of Business and Public Administration; Mr. Kahn is professor and chairman of the department of economics.

Published by Yale University Press, New Haven, Conn. Price $7.50.

History of Humble Oil & Refining Company, by Henrietta M. Larson and Kenneth Wiggins Porter. Considering the recent emergence of the Humble as the dominant name and organization of Standard Oil Co. (N.J.)'s U.S.A. operating organization, this new book is altogether timely and a worthy addition to any oil man's library.

This is the history of a small Texas company, organized 43 years ago, which became the largest producer in the United States, a leading pipeline carrier, an important refiner, and one that will soon be reckoned with as a major marketer.

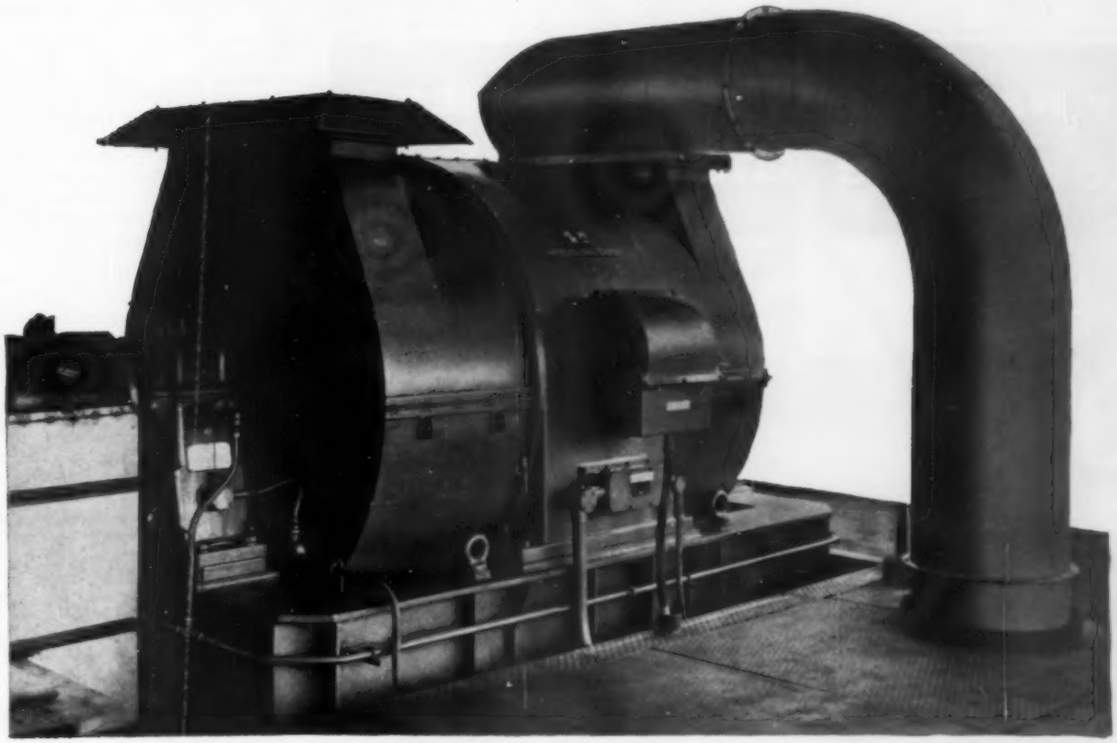
Illustrations include 32 pages of photographs and 20 maps and charts. Henrietta Larson is associate professor of business history at Harvard Business School; Kenneth Porter is professor of history at the University of Oregon. Both authors have written a number of business histories. Published by Harper & Bros., 49 East 33rd St., New York 16, N. Y. Price $7.50.

Centrifugal Pumps for General Refinery Services, API Standard 610, 3rd Edition, covers the minimum requirements for centrifugal type pumps for petroleum products, including single case horizontal and single and double case vertical pumps, but not including heavy duty, double case horizontal pumps. Order from Publications Dept., American Petroleum Institute, 1271 Avenue of the Americas, New York 20, N. Y. Price $1.50.

Protection of Idle Equipment, Chapter XVIII of the Guide for Inspection of Refinery Equipment. This is the first edition of this new chapter by the API, including a consideration of the basis of protection, the methods of protection, and procedures for specific refinery equipment. Order from Publications Dept., American Petroleum Institute, 1271 Avenue of the Americas, New York 20, N. Y. Price $1.00.

3000 hp-3000 volts,

Direct-on-line started motors at Fawley



This 3000 hp., 1485 r.p.m., 3kV motor is the largest direct-on power-line started machine to be installed in a British oil refinery; it is a Type AMS, pipe-ventilated, squirrel-cage induction motor and drives the main air compressor on the Hydroformer unit at the Esso Oil Refinery, Fawley. A similar rated machine, but force-ventilated because of the hazard, drives a hydrogen compressor on the same unit.

AEI motors are in use in oil refineries throughout the world, complete ranges of such motors have been designed by AEI Engineers to meet the specialized requirements of the oil industry. These motors embody the experience gained over many years and incorporate features which are essential to the oil industry.

AEI

Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY AND MANCHESTER

B T-H *INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V* A5529

Fire Protection in Refineries, 4th Ed., RP 2001, prepared by the Subcommittee on Fire Protection Engineering under the direction of the API Central Committee on Fire Protection, replaces the 3rd edition published in 1941. Order from the American Petroleum Institute, 1271 Avenue of the Americas, New York 20, N. Y. Price $1.00.

"Rate Schedules of the Natural Gas Pipeline Companies" (as filed with the Federal Power Commission) has been published by H. Zinder & Associates, Inc., utility consultants. 724 Ninth Street, N.W., Washington 1, D. C. Annual subscription is $10.

Economics In Action, a practical examination of oil industry economics presented at a seminar to 30 college economics teachers is being distributed by the University of Wisconsin in a booklet, "Economics-at-Action in the Oil Industry." The booklet was printed under the auspices of Standard Oil Co. (Ind.) as a contribution to a better understanding of the petroleum industry. Prof. John L. Miller is director of the program for the University of Wisconsin at Madison. Copies of "Economics-in-Action in the Oil Industry" are available from Professor Miller.

Petroleum Congress Proceedings

Eleven volumes of the proceedings of the Fifth World Petroleum Congress, containing a total of 282 technical papers, are now available from the American Petroleum Institute.

Following is a subject breakdown of the eleven volumes and the number of technical papers contained in each: Vol. I, Geology and Geophysics, 57; Vol. II, Drilling and Production, 31; Vol. III, Oil Processes and Refining, 32; Vol. LV, Chemicals from Petroleum and Natural Gas, 29; Vol. V, Composition, Analysis and Testing, 31; Vol. VI, Utilization of Petroleum Products, 29; Vol. VII, Engineering, Equipment and Materials, 22; Vol. VIII, Transportation and Distribution, 19; Vol. IX, Operations Research, Statistics and Education, 14; Vol. X, Symposium on the Applications of Atomic Energy to the Petroleum Industry, 18. The final volume, entitled the General Volume, describes the organization and events of the Congress and contains the general lectures and speeches, and a list of all Congress members and their addresses.

The technical papers are available only in volume form. Volumes are now being mailed to those who placed orders in advance. In addition, a limited number of copies are available for purchase from the American Petroleum Institute, Publication Section, 1271 Avenue of the Americas, New York 20, N. Y.

Individual volumes are priced at $12.50, plus $.50 for handling and mailing. Price of the complete set is $110, plus $5.50 in mailing charges. Congress members may obtain the volumes at $7.50 per copy, or $70 for a complete set.

Shipping Case Standards

American Standard Dimensions for Shipping Cases for Petroleum Containers, MH-7. 1-1959, has just been published by the American Standards Association, 70 East 45th St., New York, covering 13 of the most commonly used shipping cases. Price per copy is 35¢.

C. L. SUHR, a director of British American Oil Co. for the past 50 years, was recently honored by presentation of a silver tray bearing the engraved signatures of other board members plus those of all seven presidents of BA with whom Mr. Suhr has served.

HUGH M. KEELEY has been appointed regional assistant for Mobil International Oil Co.'s West Africa operations. He joined the international operations of Mobil in 1947 and worked in Turkey, Greece, Nigeria, Ghana, and Venezuela before becoming operating advisor for Africa, in New York, in 1958.

E. M. GRETZLER has retired after 40 years service with The National Supply Co. He was appointed assistant manager in 1927, and manager in 1930, of a branch then operated in Romania. In 1937 he returned to the United States as manager of export sales and was named vice president in charge of sales for The National Supply Export Corp. in 1946. Since 1956 he has been vice president of The National Supply Co. of Mexico, S.A.

American Iron and Machine Co. recently appointed **CHARLIE TRAWEEK** as South Louisiana field representative in Houma and **JACK NEFF** as field representative at Farmington, N. M.

J. P. HERRIN has been appointed chief engineer of Texas Petro Gas Co. Prior to joining Texas Petro Gas last December Mr. Herrin was with Sinclair Oil & Gas Co., most recently as senior process engineer of the Gas Products Department.

WAYNE ELLEDGE, plant engineer at El Paso Natural Gas Products Co.'s Ciniza, New Mexico, refinery, has been made chief project and mechanical engineer for the company's entire system. George Harrison succeeds him at Ciniza.

Heads New Mission District

C. E. Van Loozen has been appointed district manager for Mission Manufacturing Company's newly created western district which will encompass California and Canada. He was formerly special sales representative for Mission in Los Angeles.

New Graver Company

The Graver Tank & Mfg. Co. plant at Sand Springs, Okla., has been reorganized into a separate company which will operate as a division of Union Tank Car Co. It will be known as Graver Oil & Gas Equipment

Errata

In Mr. Wood's summary of the U.K. petroleum industry in 1959 published in the February issue two typographical errors should be noted. In the paragraph dealing with "Consumption and Fuel Policy" on Page 44 the total 1958 deliveries should have been shown as 31.1 million tons, not 3.1. In Table 1 on the following page 1958 crude imports should have been reported as 8,787 and not 8,487 million imperial gallons.

WHY HALL-SEARS GEOPHONES
lead the industry!

HS-1
4.5 - 85 CPS

HS-J
SUB-MINIATURE
Shown Half Size

The complete line of Hall-Sears geophones covers every seismic application. These fine geophones have all been designed by men who, since 1941, have created and supplied to the industry a distinguished series of seismic detectors. This series includes such innovations as the first successful miniature unit, introduced in 1950. It was this miniature geophone that made modern day pattern shooting practical.

In 1957 came the radically new dual-coil HS-1 which rapidly attained world-wide recognition as the finest geophone of its type.

Among other important new developments by Hall-Sears are:

The MP-1 pressure-sensitive geophone, generally recognized as the best in its category;

The HS-10, 2-cycle refraction geophone, which fills a long-felt need for a highly stable, very low frequency detector.

This background of success is your assurance that Hall-Sears products, in the future as in the past, will be advanced in design and manufactured to give maximum service. Hall-Sears will continue to lead the industry.

HS-2
11 - 30 CPS

HS-10
2 CPS

MP-1
PRESSURE SENSITIVE

HALL-SEARS PROVIDES THE INDUSTRY'S MOST COMPLETE GEOPHONE LINE

HALL-SEARS, INC.
2424 BRANARD • HOUSTON, TEXAS, U.S.A.
Phone: JAckson 6-2975 • Cable Address: HALSEA
WORLD WISE IN SEISMIC INSTRUMENTATION

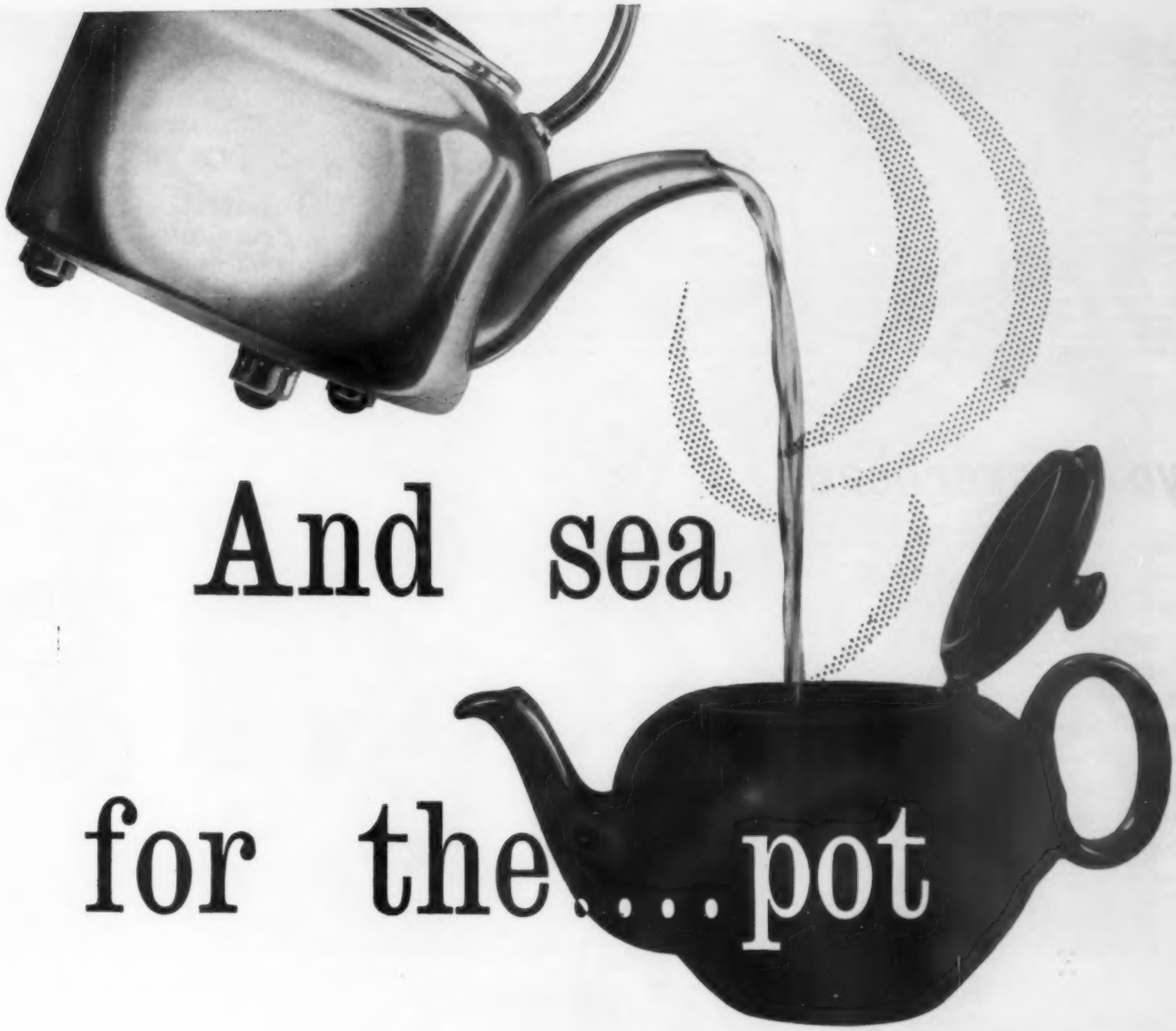
HALL-SEARS INTERNATIONAL
2424 Branard, Houston, Texas
Cable Address: HALSEA
European Branch Banstraat 2, The Hague, Holland

HALL-SEARS EUROPA, N.V.
Banstraat 2, The Hague, Holland
Cable Address: HALSEA

HALL-SEARS FRANCE, S.A.
82 Haussmann, Paris VIII eme, France
Cable Address: HALSEA

SEISMIC INSTRUMENTS LIMITED
Durham Road, Boreham Wood, Herts, England
Cable Address: SEISMIC

HALL-SEARS ALBERTA, LTD.
119 63rd Avenue, S.E.
Calgary, Alberta, Canada



And sea for the....pot

In arid parts of the World this is by no means as absurd as it sounds; recent advances in the design of flash evaporators have made it economically possible to supply entire towns with fresh water from the sea. The cost may often be less than that of a long pipeline.

This type of evaporator, which was pioneered in Great Britain by Richardsons Westgarth, will run continuously with little or no attention and does not have to be shut down for clearing of any deposit that may form. Units of up to 300,000 gallons/day are at present in operation or in production.

Since these units make use of steam at sub-atmospheric pressure they are particularly economical in connection with industries using low pressure steam or back-pressure turbines. As we are also builders of steam and gas turbo-alternators, water-tube and Economic boilers, we are particularly well able to design and carry through complete schemes, with any fuel, for the production of power and fresh water.

RICHARDSONS, WESTGARTH & CO. LTD.

The controlling Company of THE RICHARDSONS WESTGARTH GROUP

Co-ordinating the land and marine activities of:

THE NORTH EASTERN MARINE ENGINEERING CO. LTD.
RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.
PARSONS MARINE TURBINE CO. LTD.
THE HUMBER GRAVING DOCK & ENGINEERING CO. LTD.
GEORGE CLARK & NORTH EASTERN MARINE (SUNDERLAND) LTD.
RICHARDSONS WESTGARTH ATOMIC LTD.

ASSOCIATED COMPANY: ATOMIC POWER CONSTRUCTIONS LTD.

RICHARDSONS, WESTGARTH & CO. LTD., WALLSEND, NORTHUMBERLAND, ENGLAND
and at 58 Victoria Street, London S.W.1.

Aluminum Pipe

McJunkin Corp., Charleston, W. Va., has been appointed a distributor of aluminum pipe by Reynolds Metals Co. The aluminum pipe will be handled from McJunkin warehouse stock in Charleston; Pittsburgh, Pa.; Marietta, Cincinnati and Columbus, Ohio; Louisville, Ky.; Atlanta, Ga.; and Houston, Texas.

New Analyzers

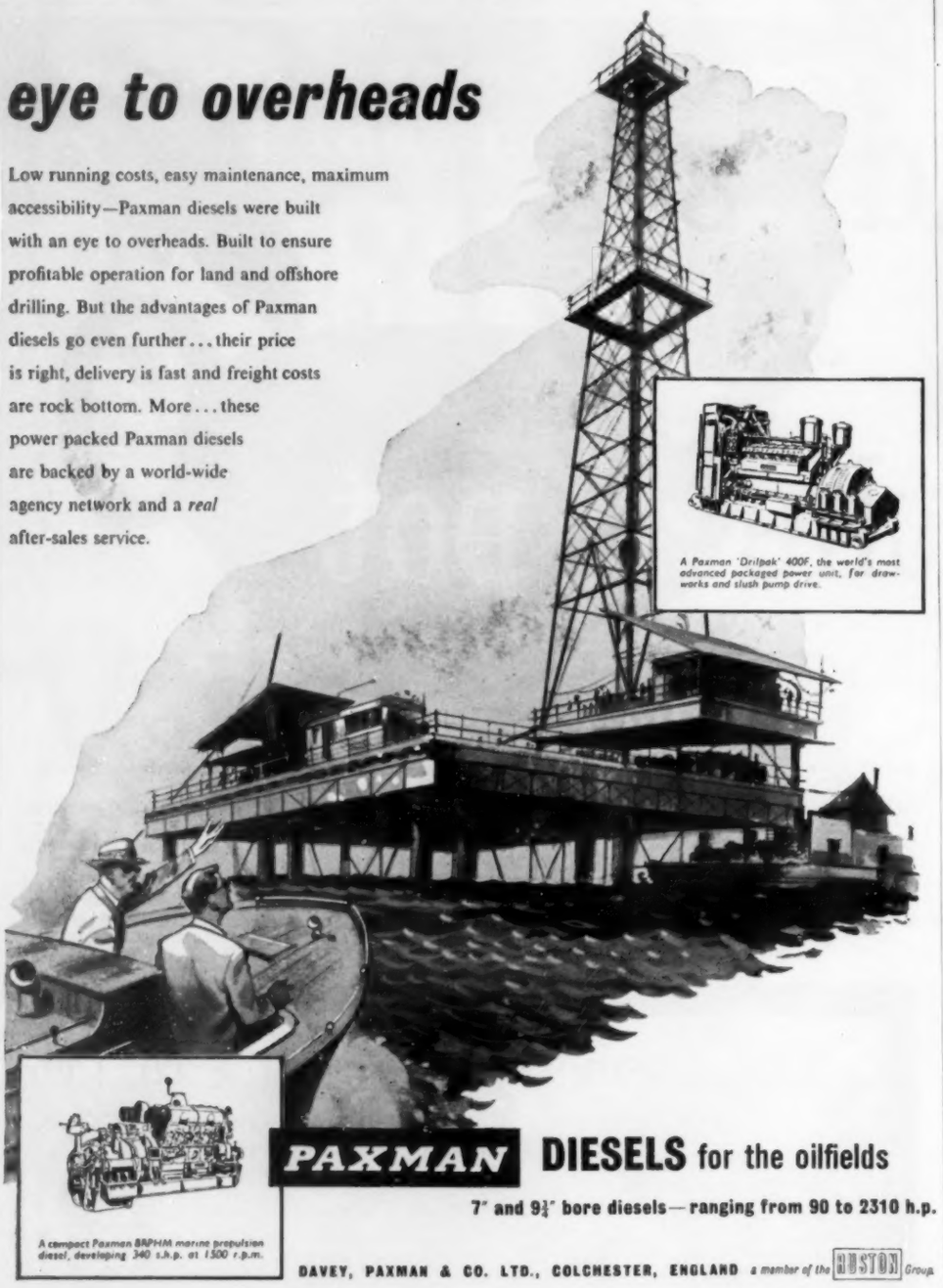
A new two-page data sheet available from Schlumberger describes its line of Nuclear Magnetic Resonance (NMR) Analyzers for hydrogen and fluorine compounds, Model 104 Hydrogen Analyzer, Model 105 Fluorine Analyzer and Model 106 Hydrogen and Fluorine Analyzer. A complete section is devoted to fluorine determinations in semi-micro amounts as part of the solid propellants studies. Copies can be obtained from Ridgefield Instrumentation Division, Schlumberger Well Surveying Corp., Ridgefield, Conn.

Hawthorne Sales Appointment

John W. Borror, veteran oil industry engineer, has been promoted to assistant sales manager at Herb J. Hawthorne, Inc., Houston. He handled various production and drilling assignments with Gulf Oil Corp. in Oklahoma, Kansas and New Mexico before World War II. Following service, Mr. Borror joined Sohio Petroleum Co. as district engineer in Oklahoma. He has been based in Houston since 1951.

New Dowell Sales Organization

A new sales organization to handle a growing list of specialty products has been announced by R. H. Smith, director of sales for Dowell Division of The Dow Chemical Co. H. E. McNeil has been appointed manager. Division engineer for the new organization will be Parke D. Muir. T. H. Bowling, formerly in the Dowell accounting department in Tulsa, is office manager in the Tulsa headquarters.


eye to overheads
Low running costs, easy maintenance, maximum accessibility—Paxman diesels were built with an eye to overheads. Built to ensure profitable operation for land and offshore drilling. But the advantages of Paxman diesels go even further... their price is right, delivery is fast and freight costs are rock bottom. More... these power packed Paxman diesels are backed by a world-wide agency network and a real after-sales service.
A Paxman 'Dritpak' 400F, the world's most advanced packaged power unit, for drawworks and slush pump drive.
A compact Paxman 8RPHM marine propulsion diesel, developing 340 s.h.p. at 1500 r.p.m.
PAXMAN DIESELS for the oilfields
7" and 9¼" bore diesels—ranging from 90 to 2310 h.p.
DAVEY, PAXMAN & CO. LTD., COLCHESTER, ENGLAND a member of the HUSTON Group
New York Representatives: Beckley, Haltom & Hickman, The Americas Building, Rockefeller Center, 1270 6th Ave., New York 20. Spares service facilities to match oilfield requirements.
PO4

J. W. Borror

D. M. Salls

Heads C-B Gas Turbine Sales

David M. Salls, manager of gas industry marketing for The Cooper-Bessemer Corp., has been named product sales manager for the company's RT-248 gas turbine. The revolutionary gas turbine, driven by a modified J-57 jet engine, was developed by The Cooper-Bessemer Corp. in cooperation with Pratt & Whitney Aircraft Division, United Aircraft Co., East Hartford, Connecticuit.

Heads Security Manufacturing

Ralph Hughes has been named vice president-manufacturing for Security Engineering Division, one of the Dresser industries. He was manager of manufacturing for the Company's plants in Dallas, Texas and Whittier, California.

Ralph Hughes

G. E. Nevill

Appointed Standards Engineer

The pressure control equipment division of Cameron Iron Works, Inc. of Houston, has appointed Mr. G. E. Nevill as engineer of standards in the product engineering department. He will represent the company on technical committees, including the American Petroleum Institute, the Association of Wellhead Equipment Manufacturers, and the Manufacturers Standardization Society of the Valve and Fittings Industry.

Willys Forms Swiss Company

Willys Overseas, S.A., a Swiss corporation, has been formed to facilitate sales of "Jeep" vehicles in markets throughout the Eastern Hemisphere. Headquarters are at Zug, near Zurich.

Chiksan International

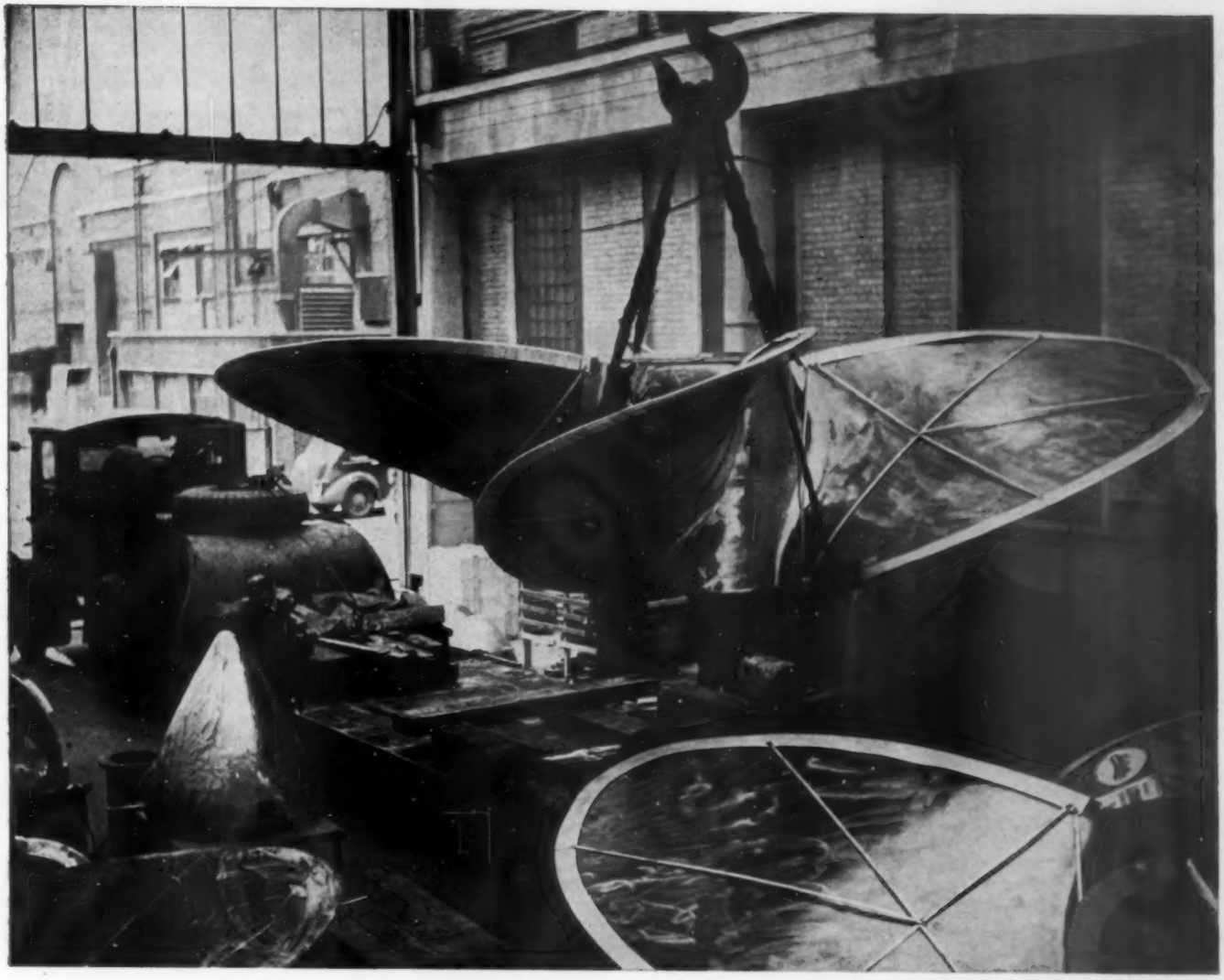
Chiksan Export Co., formerly a subsidiary of Chiksan Co., Brea, Calif., has become a division of the parent firm and has been renamed Chiksan International. Other operating divisions are Well Equipment Mfg. Corp. (Weco), of Houston, and Hamer Valves, a recent Chiksan acquisition. In Canada, Chiksan's operations are conducted by Chiksan of Canada Ltd. The new International division will maintain its headquarters at Brea. No personnel changes are involved.

Explosion Proof Diesel Locomotives

A new line of explosion proof diesel hydraulic locomotives—designed for use inside petroleum and chemical processing plants handling explosive materials—are being placed on the USA market by Henschel-Werke GmbH of Kassel, West Germany through its New York representative, Norca Machinery Corp.

Diesel Engine Maintenance

A new 24-page booklet on diesel engine maintenance has been prepared by Cummins Engine Co., Inc., Columbus, Ind. Copies are available from the sales and service department. The booklet, "Ten Maintenance Steps," tells power users how to increase equipment availability, reduce operating costs and obtain better engine performance.



Propellers of Heliston design in Stone's Bronze and Novoston alloy are well-known in this country and throughout the world, and for many years have been accepted as the solution to many of the problems associated with ship propulsion. Stone's Charlton propeller foundries are probably the largest and most specialized of their kind in the world. Production is backed by extensive laboratory facilities. Each propeller, whether large or small, is a high quality casting, formed to close tolerances and finished machined.

Heliston propellers in Stone's Bronze

J. STONE & CO. (PROPELLERS) LTD.

OCEANIC HOUSE, 1a, COCKSPUR STREET, LONDON S. W. 1.

Swiss Subsidiary Formed

A wholly-owned subsidiary, Manning, Maxwell & Moore, S.A. has been organized in Fribourg, Switzerland, by Manning, Maxwell & Moore, Inc.

The new company will take over the foreign operations throughout the eastern hemisphere. The western hemisphere will continue to be handled by the export division.

C. A. Moore, chairman of Manning, Maxwell & Moore, Inc., is chairman of the new Swiss company and J. P. Waneck has been appointed managing director. J. S. Verhaeghe has been named manager of sales and service. Mr. Waneck and Mr. Verhaeghe will be located in Fribourg.

Thread Error Detector

American Iron and Machine Works Co., Inc., Oklahoma City, has announced the development of "TEDAR," a new and unusual thread error detecting machine. The device costs over $30,000 to perfect. With the "TEDAR" machine the geometry and dimensions of taper threads are recorded by sensing devices which trace and feel the thread. This method measures simultaneously and by increments, deviations from the nominal pitch cone radius and lead.

Powers Heads Chiksan Sales

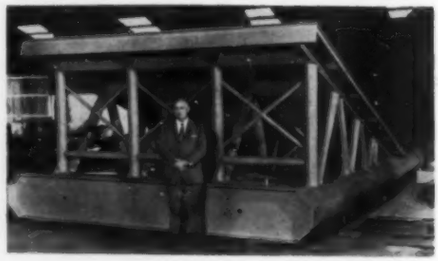
J. F. Powers, Jr. has been appointed vice president and sales manager of Chiksan Co. He has been eastern regional sales manager in Newark, N. J.

J. F. Powers, Jr.

J. B. West

Heads Cummins Latin American Sales

J. B. West has been appointed manager-western hemisphere oilfield sales for Cummins Diesel International Ltd. He will represent Cummins in Latin America and Mexico. He will reside in Sao Paulo, Brazil. Prior to joining Cummins, Mr. West was located in Rio de Janeiro for Oil Well Supply.



Portable Sea Wall

A. L. Smith of Petroleum Instrument Co., Houston, has designed a mobile breakwater, the Sea Raft, which is being tested by the Army Corps of Engineers. The designer believes that it will have important applications in protecting offshore oil installations from wave action and aid in underwater pipeline construction. The Sea Raft is an inclined wall supported by a buoyant structure of large diameter pipe. In service the wave water mass climbs the inclined wall until its momentum is dissipated when the water rolls back seaward.

Shannon Joins Hughes Tool

Pierce Shannon has joined Hughes Tool Co. as manager of sales promotion. He will also be assistant advertising manager, reporting to G. J. Meyer. Prior to joining Hughes, Mr. Shannon was with Foote, Cone & Belding, Advertising, in Houston, and was assigned to the Hughes account. He previously was editor of *Drilling Magazine*.

Stekoll Expansion Planned

The Chase Manhattan Bank of the City of New York has loaned Stekoll Petroleum Corp. $7 million to further the company's current expansion program. The company has farmouts or leases on 27,000 gross acres in Canada. Crude production from its Canadian holdings averages 3,500 b/d. It also operates in Venezuela and has holdings which it intends to develop in Trinidad.

International Engine Catalog

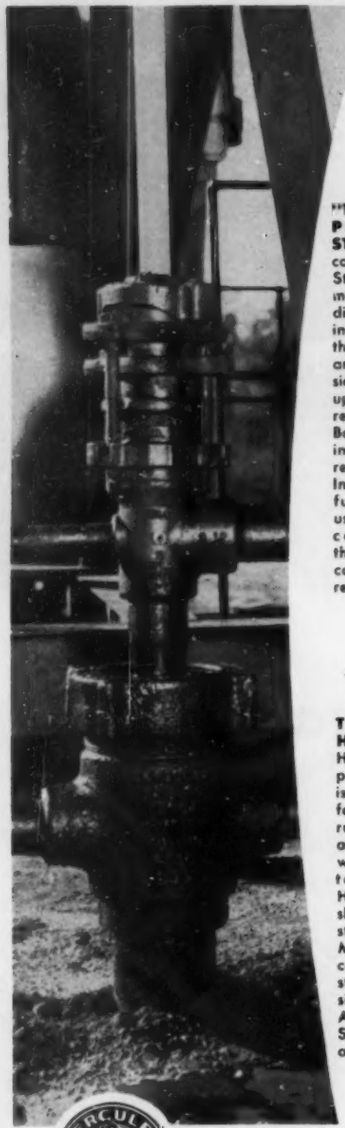
The International UDT-817 six-cylinder diesel engine the most powerful unit of its type manufactured by International Harvester Co.'s Construction Equipment Division—is the subject of a 16-page catalog just issued. Write International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., for Catalog CR-607-I.

Harris Offices Moved

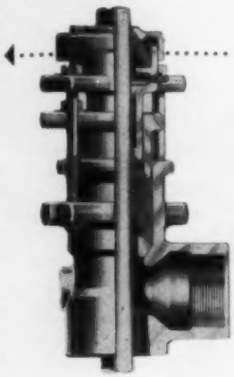
Frederic R. Harris, Inc., consulting engineers, have moved their offices to the mid-town area in New York. New address is 144 East 44th St.

HERCULES products in ACTION

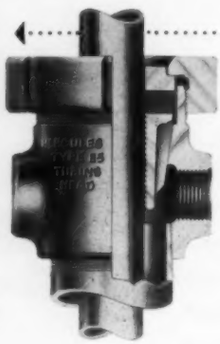
A typical set-up is shown below in Creek County, Oklahoma, using Hercules "Tee Type" Duplex Polished Rod Stuffing Box and Type "E5" Tubing Head. This is an easily assembled, effective and economical producing unit.



"TEE TYPE" DUPLEX POLISHED ROD STUFFING BOX—A combination Tee and Stuffing Box with female thread to screw directly onto the tubing, eliminating one threaded connection and resulting in a considerably shorter hook-up. With internal parts removed, the Stuffing Box body is full opening and need not be removed to pull rods. In addition to being furnished in the most used sizes, special combinations of threads and outlets can be furnished on request.



TYPE "E5" TUBING HEAD—This Tubing Head is ideal for any pumping situation. It is economical enough for shallow wells and rugged enough for any depth well, with working pressure up to 1500 pounds. Hercules self-aligning slips suspend the inner string in this Head. Mandrel suspension can be furnished instead of slips, if desired, at no extra cost. A neoprene Tubing Stripper Unit is also available.



Write for complete information on any Hercules Product.

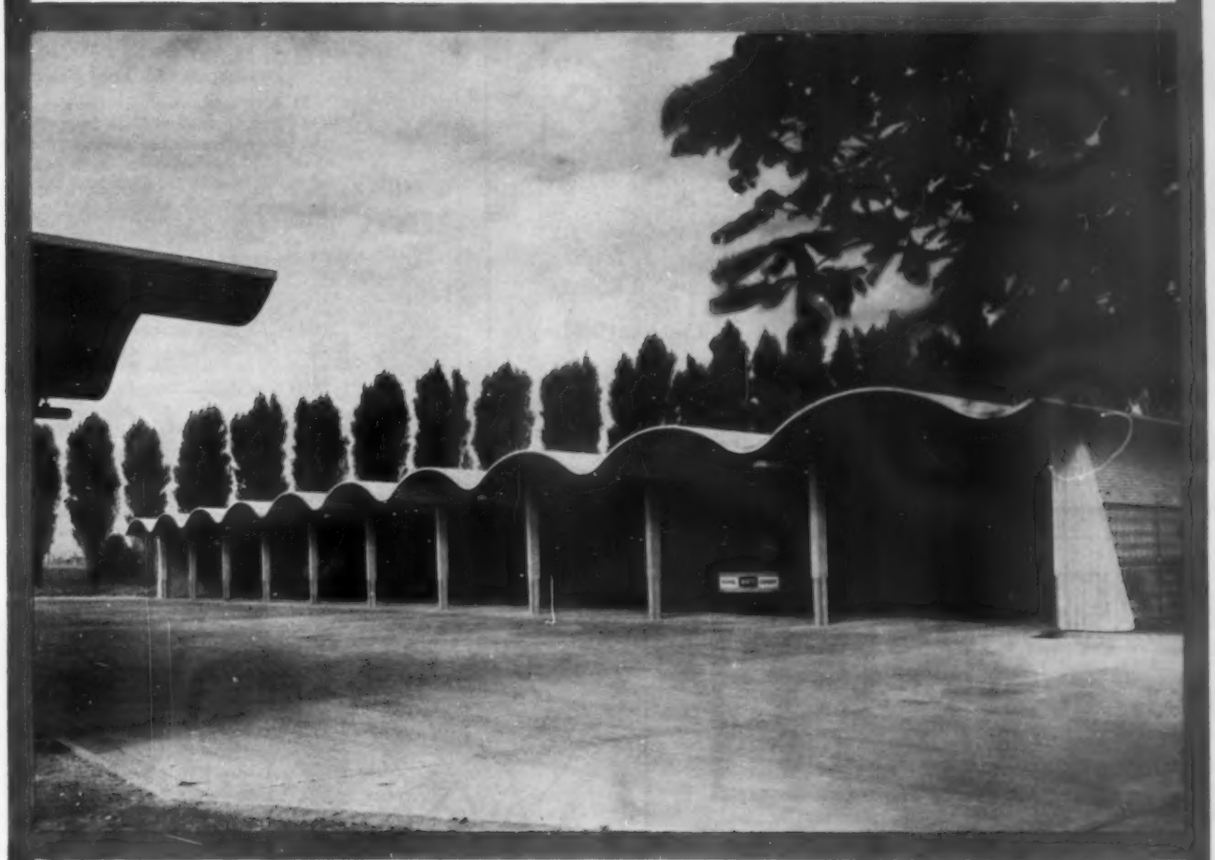
HERCULES TOOL COMPANY

MANUFACTURERS OF OILFIELD EQUIPMENT

GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA

Export Representative Oil Field Equipment Co., Inc. 90 West Street, New York, N. Y.

Lorry Garage in Buckinghamshire



Consulting Engineers for Shell Roof: Ove Arup & Partners

TILEMAN

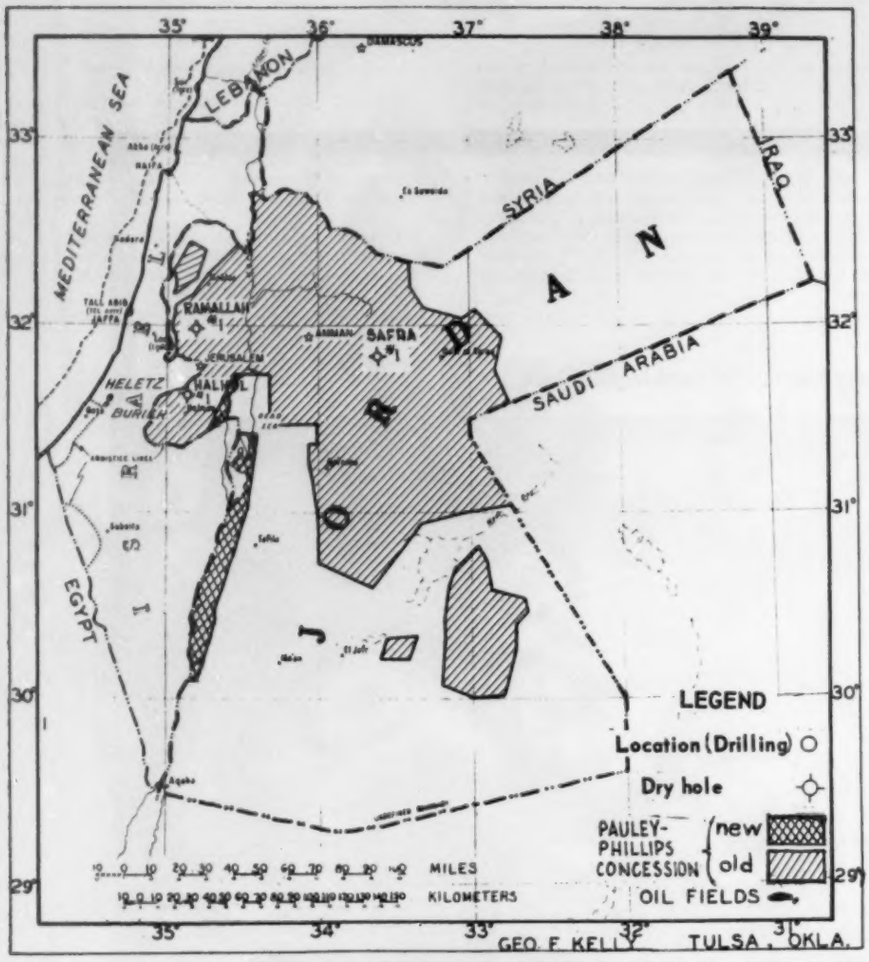
& COMPANY LIMITED

Specialists in the design and construction of reinforced concrete for power and industry

ROMNEY HOUSE, TUFTON STREET, LONDON, S.W.1. Tel: ABBey 1551

TIL 439

ST



◁ *Phillips Petroleum Co. has been granted two new areas (see map) which extend the area of the petroleum concession previously granted to Edwin Pauley and now operated by Phillips. An exploratory well is drilling at present.*

R. E. Dunn

D. E. Whittenberg

Garrett Oil Tool Promotions

D. E. Whittenberg, vice president-sales, for Garrett Oil Tools, Division of U. S. Industries, Inc., will assist the president with the general administration of the division in the future and serve as a general manager of the division in the absence of the president. Robert E. Dunn formerly assistant general sales manager of Cardwell Manufacturing Co. has been named manager of marketing.

Dresser Industries Sales Up

Dresser Industries, Inc. reported sales of $232,310,000 in 1959, an increase over the previous year's volume of $225,288,000 despite lengthy strikes at Clark Brothers and Security Engineering. Earnings totaled $9,171—a decline from $9,882 in 1958.

Cummins Diesel Elects Directors

Dr. Hans Berger and Mr. J. T. Hanou have been elected directors of Cummins Diesel International Ltd. Dr. Berger is a resident of Zurich, Switzerland. Mr. Hanou was appointed manager of the international division on January 1.

IDECO-WOODFIELD
***Streamlined* ROTARY TABLES**
. . . available from England

. . . with the following features

★ *Built-in safety features; non-slip surface; no projections.*

★ *Fabriform steel case for maximum strength, minimum weight.*

★ *Positive one-point lubrication; all moving parts—oil-bathed.*

★ *Precision-built; effective top and bottom neoprene mud-seals.*

★ *Practical design; separate replacable pinion shaft capsule.*

IDECO WOODFIELD

WOODFIELD ROCHESTER LTD.
FRINDSBURY WORKS · ROCHESTER · ENGLAND
TELEPHONE: STROOD 78421
Woodfield manufacture Ideco Oilfield Equipment

The best records are made with GEOLOGRAPH RECORDERS!

Yes, GEOLOGRAPH recorders give you the most complete record available while the well is drilling.

This is our "Fifth-of-a-Century" of superior service to the oil industry.

In all ways it always pays to log as you drill with a GEOLOGRAPH recorder, which combines the exclusive, unique "Trip Action" and "Magna-Sensor" features.

For information contact the Export Division

THE GEOLOGRAPH COMPANY
MANUFACTURERS ● EXPORTERS
27 N.E. 27TH • P.O. BOX 1291 • OKLAHOMA CITY 1, OKLA.

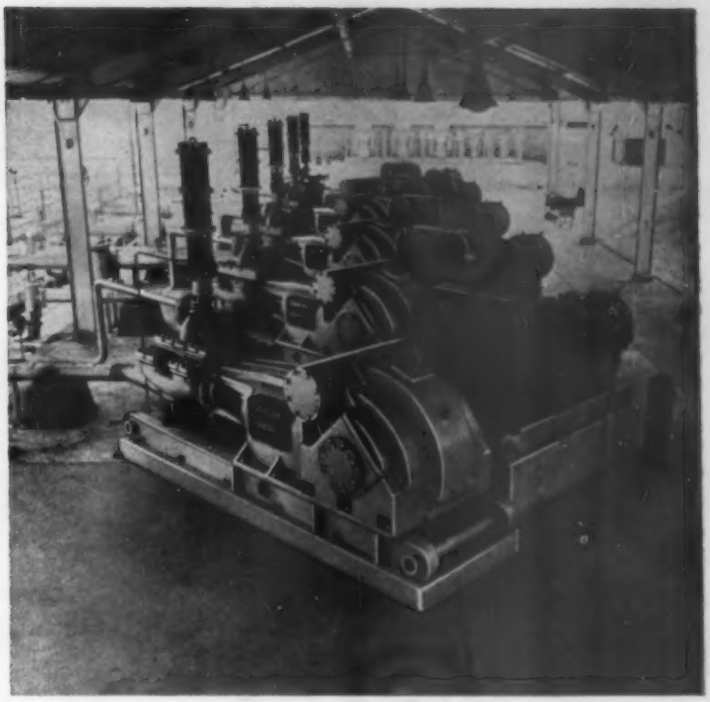
OIL PIPE LINE

PUMPS

We manufacture a range of pumps with capacities up to 30,000 barrels per day—discharge pressures up to 1250 p.s.i.

★ ★ ★ ★ ★ ★ ★

Illustrated is a series of pumps supplied to the British Petroleum Company's Oil Refinery at Aden for pumping diesel and fuel oils from the refinery to the B. P. International Oil Bunkering installation.



Dawson & Downie Ltd

Elgin Works
Clydebank
Scotland

Telephone: Clydebank 2271/2/3
Telegrams: "PUMPS" CLYDEBANK

ARE YOU mass-producing ?

Better see us about the castings. You'll want a continuous supply of exact, flawless castings and we have the technical teamwork to give it to you. See us soon, let our design engineers in on the ground floor. That way—without departing from your essential specification—you can be sure that the final casting is completely free from hidden structural fault. And when production begins, leave it to our metallurgists and foundry engineers to ensure that the soundness and accuracy of every casting is faithfully maintained.

BIRSO TRADE MARK BN

CASTINGS FROM A FEW OUNCES TO TEN TONS . . .

in phosphor-bronze, manganese-bronze, aluminium-bronze, gun-metal, and light alloys. Specialists in high-tensile aluminium bronze castings, centrifugal-cast wheel blanks, shell moulded castings, and chill-cast rods and tubes. Continuous cast phosphor-bronze bars up to 12 foot lengths.

NON-FERROUS CASTINGS
HIGH DUTY IRON CASTINGS • PRECISION MACHINED BUSHES & BEARINGS

T. M. BIRKETT, BILLINGTON & NEWTON LTD

HANLEY AND LONGPORT, STOKE-ON-TRENT, ENGLAND

Head Office: HANLEY, Phone: Stoke-on-Trent 22184/5/6/7. LONGPORT, Phone: Newcastle, Staffs 51433/4.

Let
VOKES
solve your problems of...

. . . noise . . .

Vokes silencers are scientifically designed to give maximum noise reduction at minimum back pressure. This principle is applied in a wide range of industrial applications including engine exhaust, discharge from rotary blowers, vacuum pumps and steam safety valves and the intake of reciprocating compressors and rotary blowers. Write for descriptive catalogues.

. . . pulsation . . .

Vokes pulsation dampeners reduce pipe-line surges which cause mechanical vibration, noise or expensive fatigue failure; in fuel gas lines consequent steady combustion effects great savings. They are individually designed to suit the particular installation and are available for all pressures, all gases and air pipe sizes, both for suction and discharge service, in single or multiple applications. Full details supplied on receipt of detailed enquiry.

. . . mist!

Vokes mist-eliminators give the cleanest separation between liquid and vapour. Their scientific wire mesh construction gives an efficiency rating of over 99.9% with minimum pressure drop, thus increasing output, eliminating product loss and reducing contamination. Vokes mist-eliminators are also individually designed to suit the particular installation either as single elements or in "sandwich" form between specially constructed grids. Full details supplied on receipt of detailed enquiry.

VOKES

Air and Gas Filters for Chemical, Nuclear Energy, Oil Refinery and Pharmaceutical applications, etc; Air conditioning filters; Compressed air pipeline filters; Air, Oil, and Fuel filters for Diesel, Gas Turbine, and other i/c engines; Hydraulic filters; Silencers for Engines, Fans and Blowers; High efficiency Multi Cyclones.

VOKES LTD · GUILDFORD · SURREY · ENGLAND

Telephone: Guildford 62861 (6 lines)

NEVADA'S COMPLETE RESORT HOTEL!
Name your fun! You'll find it in abundance at Wilbur Clarks Desert Inn! Exciting night life...spectacular floor shows...dancing...delightful cuisine...Olympic-size pool...18-hole championship golf course!
500 DELUXE ROOMS & SUITES AT MODERATE PRICES
Now! On Stage!
JIMMY DURANTE
May 5-8, 1960
8th TOURNAMENT OF CHAMPIONS
Wilbur Clark's
DESERT INN
& COUNTRY CLUB
Las Vegas, Nevada

Every Petroleum Executive,
Engineer,
Driller,
Contractor,
Operator
Needs a copy of
THE ENLARGED
FIFTH EDITION OF

THE BRANTLY ROTARY DRILLING HANDBOOK
to keep abreast of the most recent developments.

Discoveries and inventions, improved techniques and new equipment required a complete re-writing of this standard authoritative work. All tables, *filling 206 pages,* have been rechecked, revised, and expanded. New tables have been added. A glance at the Table of Contents will show the scope of the treatment provided in this 702 page book. There are 206 pages of tables, a glossary, illustration, charts and diagrams.

Order your copy today, 702 pages, fabricoid cover, price $10.00. Write us for quantity discounts.

Published by
PALMER PUBLICATIONS
604 Fifth Avenue, New York City 20

CENTER SEAT FOR OPERATOR — Sitting in seat located directly over center of machine, operator can keep casing lined up perfectly with hole being bored.

REVERSE-O-MATIC TRANSMISSION — With this new type transmission, operator can switch auger from forward to reverse without engine slowdown. No gear shifting.

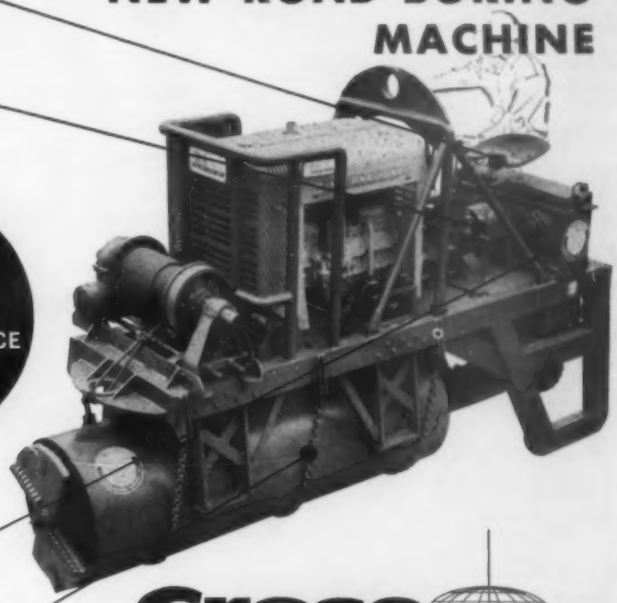
HEAVY DUTY TORQUE CONVERTER — For full, constant speed and smooth power flow, eliminating up to 90% of shock load imposed on drive train.

CROSE

NEW ROAD BORING MACHINE

The new Crose Road Boring Machine provides the fastest, simplest, most economical way for boring crossings and installing casings up to and including 42" in diameter. Heavy duty torque converter and reverse-o-matic transmission deliver full, constant speed and smooth power flow . . . let you switch auger from forward to reverse without engine slowdown . . . no gear shifting.

FIELD-TESTED TOP PERFORMANCE



The smaller Model RBA Crose Road Boring Machine is still available for casing up to 24".

WRITE CROSE TODAY FOR COMPLETE INFORMATION

NEW GEAR AND CHAIN BOX — With pressure lubrication feature — has been added to the new Crose Road Boring Machine for greater power capacity.

CASING CLAMP BANDS ELIMINATED — Instead, you use adjustable casing chains which can be easily installed or removed when machine is in ditch.

Crose perrault EQUIPMENT CORP.

2765 Dawson Road • Phone WEbster 6-2171 • Tulsa, Oklahoma •
BRANCH OFFICES: Houston, Texas • Elizabeth, N. J. • IN CANADA:
Edmonton, Alberta • Toronto, Ontario • EXPORT OFFICE: New York, N. Y.

MILLENNIUM KEY

Quality Castings for Refinery and Chemical Plants

✱ *Please write for bulletins which give full technical information on each type of casting*

TYPE 6150

LAKE & ELLIOT, LTD.

BRAINTREE • ESSEX • ENGLAND • *Telephone:* BRAINTREE 1491

American Iron & Machine Works Co. Subsidiary
American Machine & Foundry Co. Cover III
Lowe Runkle Company

American Machine & Foundry Co., American Iron & Machine Works Co., Div. Cover III
Lowe Runkle Company

A. E. Ames & Company, Ltd. 90
MacLaren Advertising Co., Ltd.

Associated Electrical Industries Ltd. Switchgear Division 93
Technical & General Advertising Agency, Ltd.

Baash-Ross Tool Company 56
Ullrich & Brown Advertising

Birkett, Billington & Newton Ltd. 101
S. C. Peacock Ltd.

British Petroleum Company, Ltd. 77
S. H. Benson Ltd.

Burton Delingpole & Company, Ltd. 83
E. H. Wright & Company, Ltd.

California Texas Oil Company, Ltd. 21
Gaynor & Ducas, Inc.

Cameron Iron Works, Inc. 5
Boone & Cummings

Cape Asbestos Company, Ltd. 71
Taylor Advertising Ltd.

Chrysler International S.A. 91
Publicontrol S.A.

Wilbur Clark's Desert Inn 102
Lennen & Newell, Inc.

Crose-Perrault Equipment Corp. 103
Paul Locke Advertising Inc.

Cummins Engine Company, Inc. 28-29
Gotham-Vladimir Advertising, Inc.

Davey, Paxman & Company, Ltd. 96
Industrial Publicity Ltd.

Dawson & Downie Limited 101
James Jack Advertising Ltd.

Decca Navigator Company, Ltd. 61
John Tait & Partners, Ltd.

Dresser Industries, Inc. 23
Persons Advertising, Inc.

E. I. duPont deNemours & Co., Petrochemicals Div. 31
The Rumrill Co., Inc.

English Electric Company, Ltd. 30
Technical Advertising Service

Gardner-Denver Company 22
The Buchen Company

Garrett Oil Tools, Inc. 58-59
Glenn Mason, Cunningham & Associates

ADVERTISERS' INDEX

(Advertising Agencies in Italics)

General American Transportation Corporation 25
Edward H. Weiss and Company

Compagnie Générale de Géophysique 87
OEDIP

Geolograph Company 100
Lowe Runkle Company

Matthew Hall & Company, Ltd. 75

Hall-Sears, Inc. 94
Persons-Beauchamp Advertising, Inc.

Halliburton Oil Well Cementing Company 38
Heintz & Company, Inc.

Frederic R. Harris, Inc. 70

Herb J. Hawthorne, Inc. 92
Robinson-Gerrard-McGary, Inc.

Hercules Tool Company 98
Keefe Advertising Agency

Hughes Tool Company 18-19
Foote, Cone & Belding

I.C.I. Billingham Division 79
Clifford Martin Ltd.

I.C.I. Heavy Organic Chemicals Division 10
Clifford Martin Ltd.

International Harvester Export Company 1
McCann-Erickson Corporation (International)

Jensen Brothers Mfg. Co., Inc. 104
Bryan & Bryan Advertising

Laboratoire Industriel D'Electronique BELIN 63
G.E.A.D.

LaCoste & Romberg 74
Marvin Gwinn & Associates, Inc.

Lake & Elliot, Ltd. 103
Ripley, Preston & Company, Ltd.

H. & E. Lintott, Ltd. 36
R. F. White & Son Ltd.

London & Midland Steel Scaffolding Co. Ltd. 34
S. H. Wright & Company, Ltd.

Lucey Export Limited 11
Sam J. Gallay, Advertising

Lummus Company 2
G. M. Basford Company

McCullough Tool Company 33
Raymond O. Perry, Advertising

Milwhite Mud Sales Company 89
Boone & Cummings

Perkins Engines Limited 32
Crane Publicity Ltd.

Petrolite Corporation 67
Batz-Hodgson-Neuwoehner, Inc.

Procon Incorporated 27
Tobias, O'Neil & Gallay, Inc.

Reed Roller Bit Company Cover IV
Rives, Dyke & Company

Reynolds Metals Company 20
Gotham-Vladimir Advertising, Inc.

Richardsons, Westgarth & Company, Ltd. 95
Notley Advertising Ltd.

Rogers Geophysical Companies 37
Rives, Dyke & Company

Schlumberger Surenco 55
Rives, Dyke & Company

Seismograph Service Corporation 85
Watts, Payne-Advertising, Inc.

Smith Tool Company 24
Darwin H. Clark Company

Southwestern Industrial Electronics Co. 7
Richard L. Minns, Allstate Advertising, Inc.

Peter Spence & Sons Ltd. 65
Holmwood Advertising, Ltd.

Standard Oil Company (New Jersey) 26
McCann-Erickson, Inc.

Standard-Vacuum Oil Company 17
McCann-Erickson Corp. (International)

J. Stone & Company (Propellers) Ltd. 97

Texas Instruments Incorporated 13
Robinson-Gerrard-McGary, Inc.

Tileman & Company, Ltd. 99
Scott-Turner & Associates, Ltd.

Universal Oil Products Company 14-15
Tobias, O'Neil & Gallay, Inc.

Universal Oil Products Co., Products Dept. 35
Tobias, O'Neil & Gallay, Inc.

Vokes Limited 102
Trowbridge Pritchard & Company, Ltd.

Warren Petroleum Corporation Cover II
Chapman Company

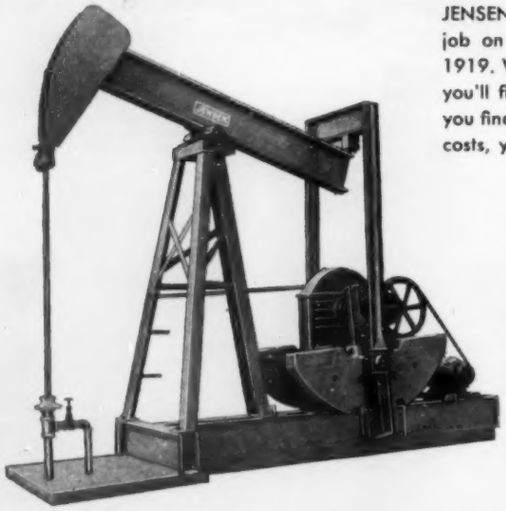
Western Geophysical Company 9
L. J. Swain, Advertising

White Motor Company 68-69
Fuller & Smith & Ross Inc.

Williams Brothers 86
Ferguson-Miller Associates

Woodfield Rochester Ltd. 100
KS Advertising Ltd.

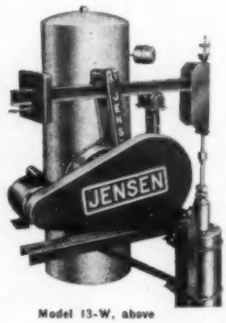
For OIL . . .



JENSEN JACKS have been doing a good job on oil wells around the world since 1919. Wherever you find oil, chances are you'll find JENSEN JACKS, and wherever you find oilmen with an eye on production costs, you're *sure* to find JENSEN JACKS.

There is a JENSEN for any well depth and a type for any pumping condition: JENSEN Beam Balanced, the standard of the oil industry; JENSEN Rotary Balanced, easily adjusted by one man, standing on the ground; JENSEN Combination Balance, incorporates the advantages of both beam balance and rotary balance. Write for FREE catalog.

For WATER . . .



Model 13-W, above

JENSEN WATER SYSTEMS are ruggedly designed for long life and trouble-free service. They are completely counterbalanced—which explains why they pump more water with only about half the power required by other makes. Self priming. Write for FREE catalog of JENSEN Water Systems and water well accessories.

Size	Model 11-W		Model 13-W		Model 25-DC	
Cyl.	Depth	G.P.H.	Depth	G.P.H.	Depth	G.P.H.
1⅜"	120'	97	365'	105	700'	110
1⅞"	70'	180	150'	200	340'	205
2½"	20'	290	40'	323	180'	363
2⅞"			10'	473	90'	530

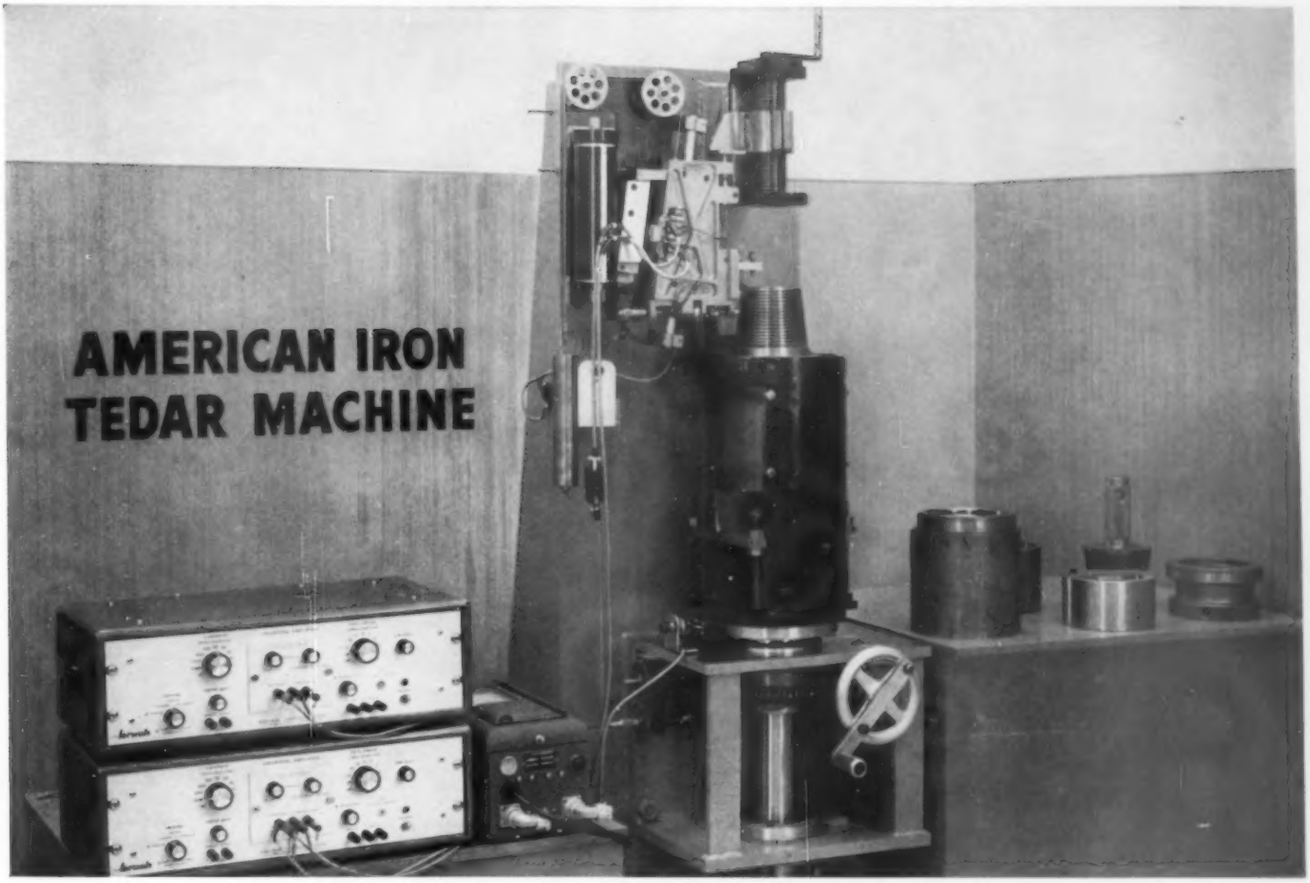
Other intermediate sizes and models to 5000 feet.

DISTRIBUTORS WANTED

Made by JENSEN BROS. MFG. CO. INC., Box 477-K, Coffeyville, Kansas

Export Office: 250 Park Avenue, New York 17, N. Y.

JENSEN JACKS



THREAD ERROR DETECTING AND RECORDING MACHINE (TEDAR)

THE ONLY MACHINE OF ITS KIND IN THE WORLD! . . .

Here an engineer is analyzing a recorded chart of a tool joint thread from the TEDAR.

Assures longer service for AMERICAN IRON tool joint threads!

The TEDAR machine, developed exclusively for AMERICAN IRON by a famous research institute, gives minute control of thread gauge accuracy.

Until the invention of the TEDAR, threads were measured grossly by gauges. Now, the actual geometry and dimensions of taper threads are recorded by sensing devices which trace and feel the thread.

These recordings give AMERICAN IRON information previously unobtainable. The result—the manufacture of longer lasting threaded connections through this regulated quality control. This is just one of the many tests used in tool joint manufacturing at AMERICAN IRON.

For longer, trouble-free tool joint service, specify AMERICAN IRON. Available in Straight Grip or Flash Welded, with API or Open-Hole Threads.

TEDAR . . . Another reason why you buy QUALITY when you specify AMERICAN IRON

AMERICAN IRON
AMF
PETROLEUM EQUIPMENT
AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma

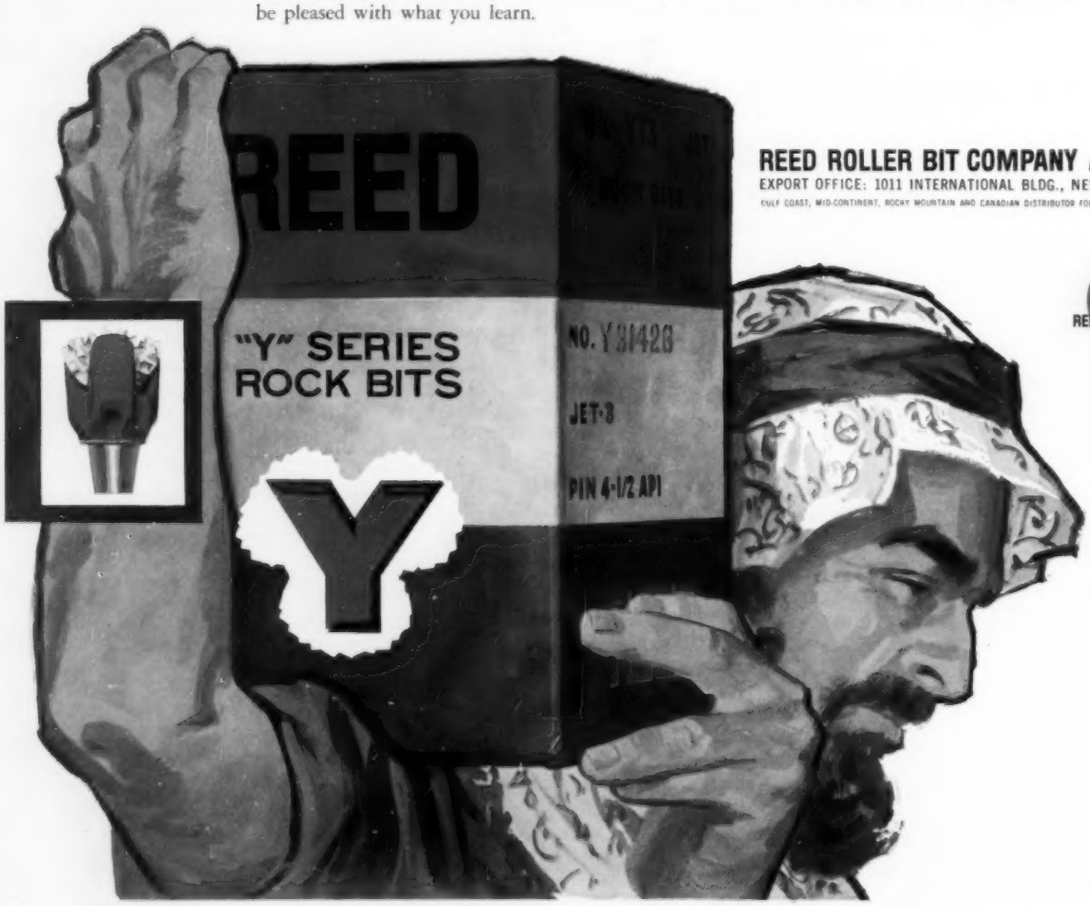
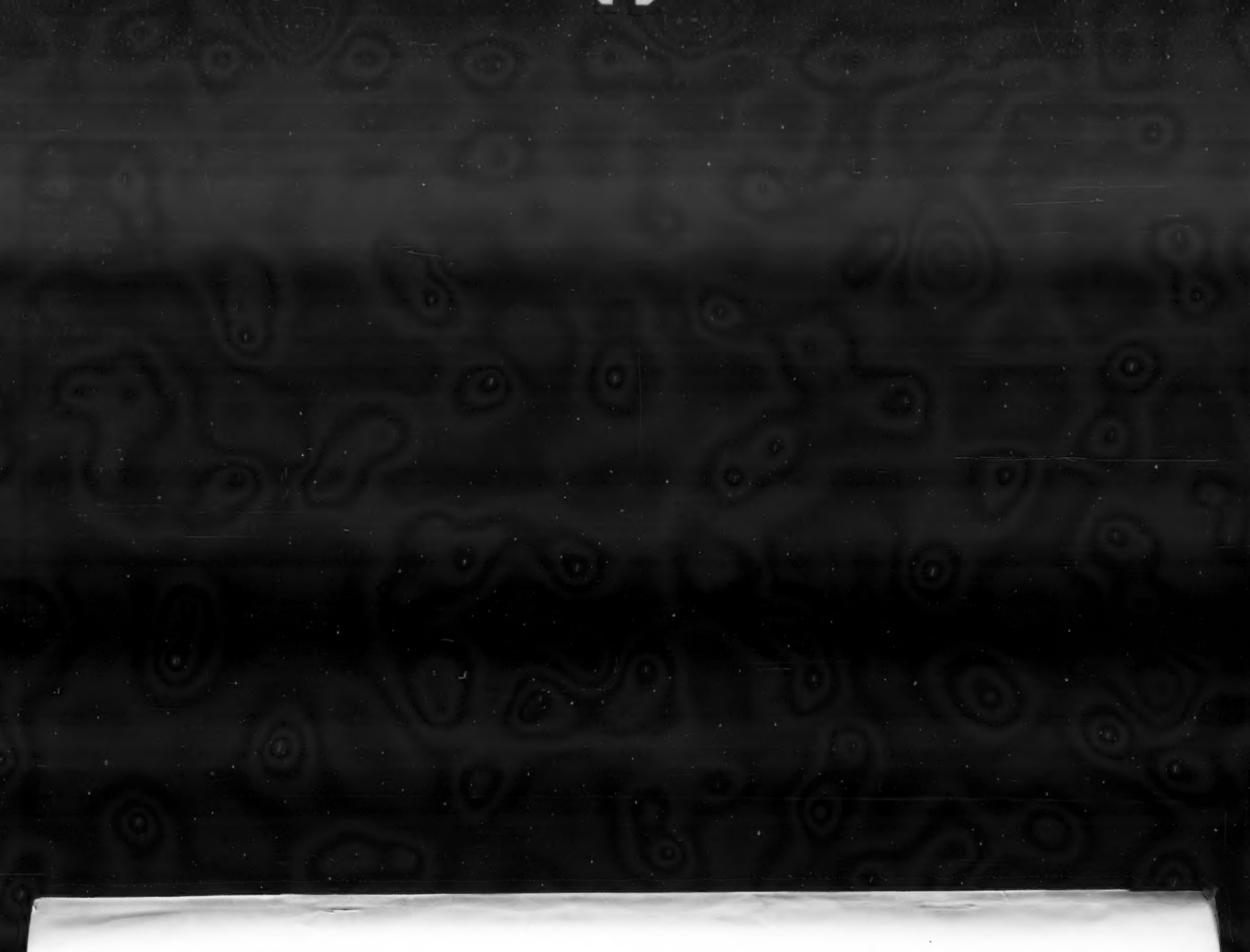
WHEREVER YOU DRILL YOU'LL FIND REED "Y" BITS OUTSTANDING

Reed Y bits are doing an outstanding job because they are designed, engineered, and manufactured for one purpose—to dig a straight, full gage hole in the least possible time.

The advanced design of these bits, using special steels and precise manufacturing control, results in one of the most efficient tools on your rig.

The proof of the effectiveness of these bits is the increasing number of outstanding records we are receiving from the field. Wherever you're drilling, in the States or abroad, we can show you how Reed Y bits can help you get down hole faster.

There's a Reed man near you, wherever you drill. Let him tell you the full story. You'll be pleased with what you learn.



REED ROLLER BIT COMPANY *Houston 1, Texas*
EXPORT OFFICE: 1011 INTERNATIONAL BLDG., NEW YORK 20, N. Y.
GULF COAST, MID-CONTINENT, ROCKY MOUNTAIN AND CANADIAN DISTRIBUTOR FOR MARTIN-DECKER PRODUCTS.